Consulting Engineer

September 1958

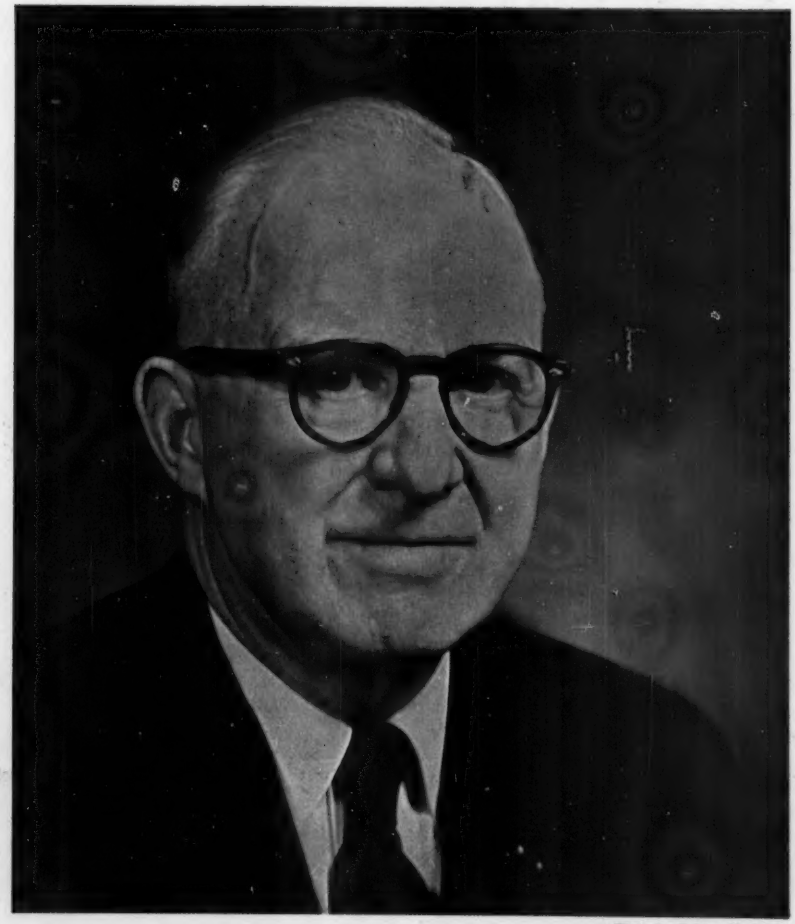

Photo by Fabian Bachrach

FRANCIS S. FRIEL of Philadelphia, president-elect of the American Society of Civil Engineers, currently handles an average of 100 engineering projects a year, yet still finds time to serve as an officer of a bank, two universities, and an impressive list of engineering organizations. President of Albright & Friel, Inc., one of the oldest consulting engineer

Continued on page 10

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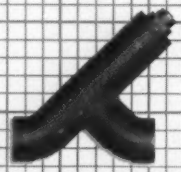

Fig. 1365A—Small Steel Pressure Seal "Y" Check Valve for 1500 pounds W.S.P. Socket weld ends. Sizes ½" to 2". Also available for 2500 pounds in sizes ½" to 3".

Fig. 11303—Steel Pressure Seal Gate Valve for 1500 pounds W.S.P. The higher the pressure within the valve the tighter the seal at body-bonnet joint. 600, 900, 2500 pound valves can be furnished.

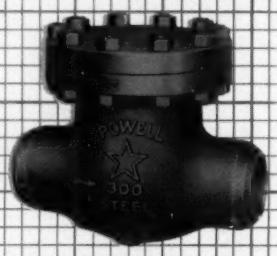

Fig. 3061A WE—Newly designed Steel Swing Check Valve for 300 pounds W.S.P. Has straight flow through area when disc is in wide open position.

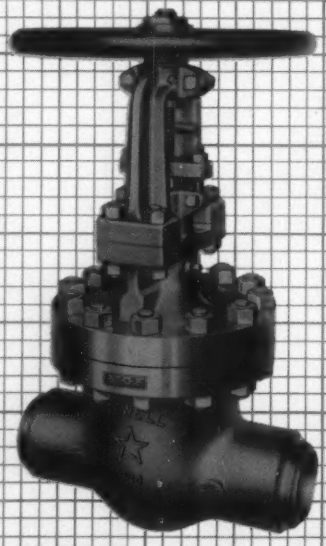

Fig. 9003 WE—Steel Gate Valve for 900 pounds W.S.P. Outside screw rising stem and yoke. Solid wedge disc. Steel valves are available for pressures from 150 through 2500 pounds.

Fig. 512—Small Bronze Gate Valve for 150 pounds W.S.P. Inside screw non-rising stem. Solid wedge disc. Can also be supplied with flanged ends.

Fig. 1444—Large Iron Body Bronze Mounted Gate Valve for 125 pounds W.S.P. Outside screw rising stem and yoke. double wedge disc. Also available with solid wedge disc.

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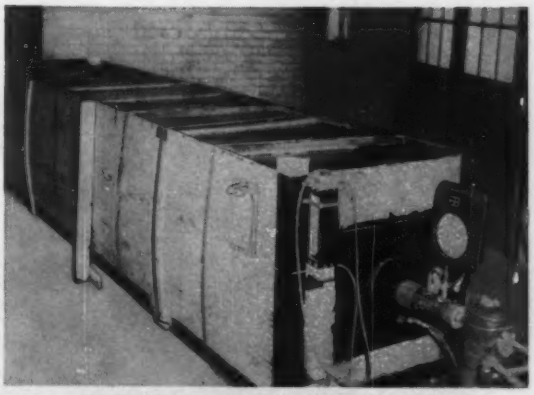

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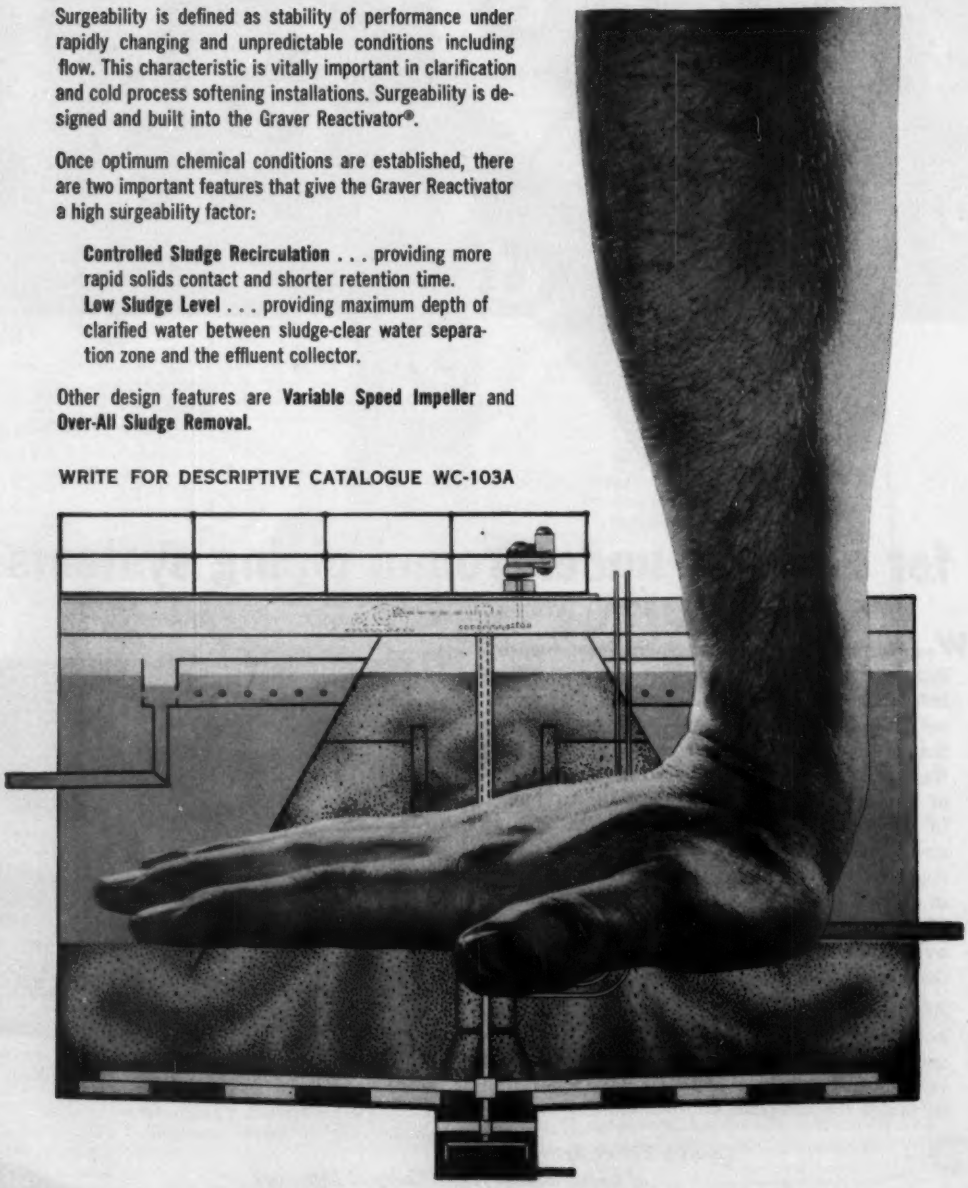

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September 1958 • VOLUME XI • NUMBER III

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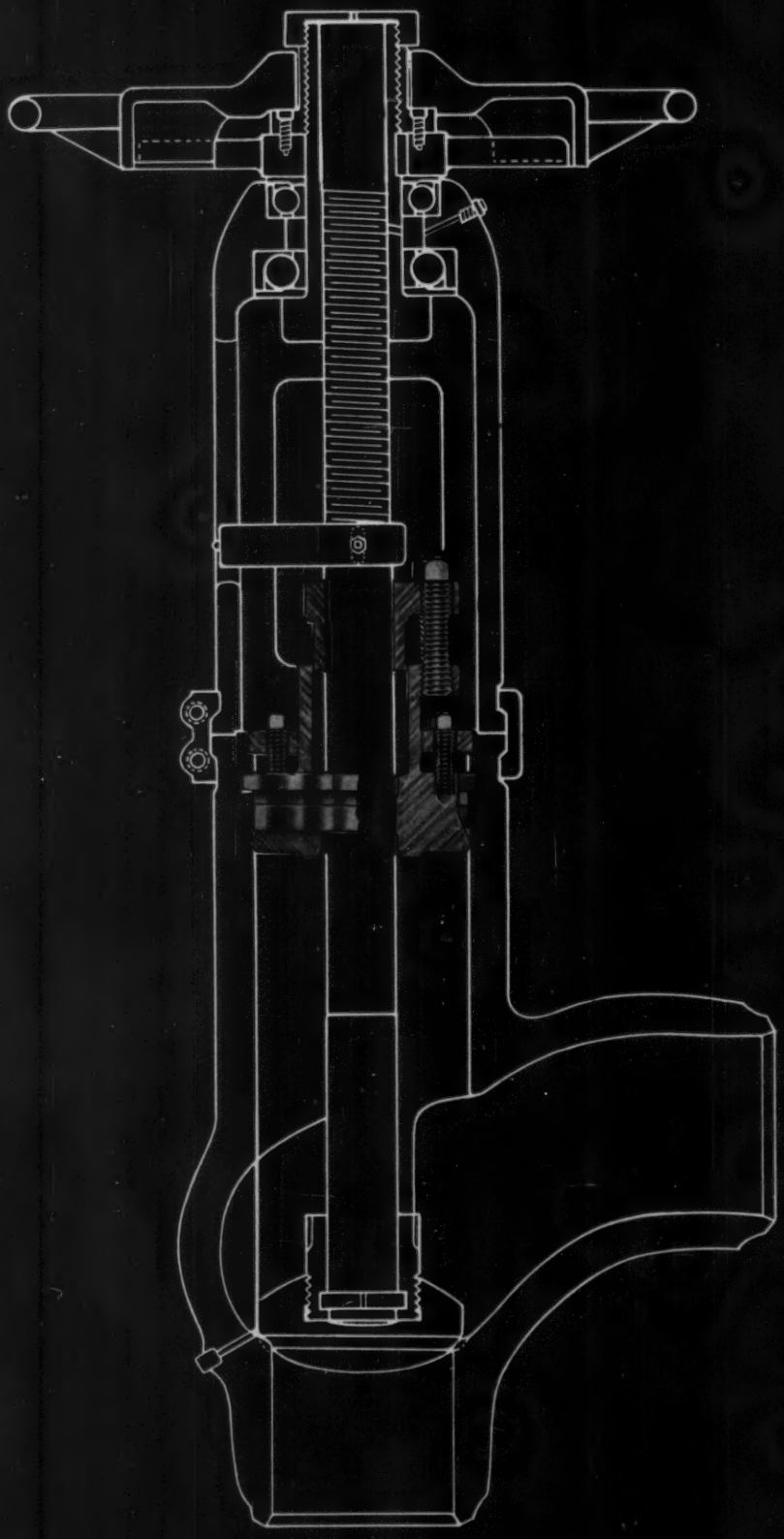

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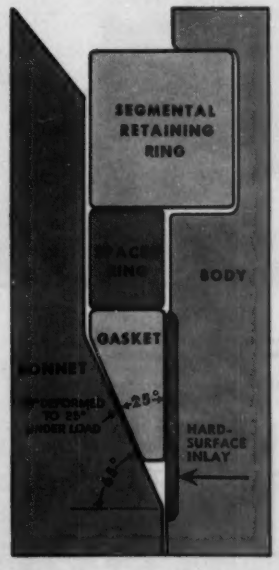

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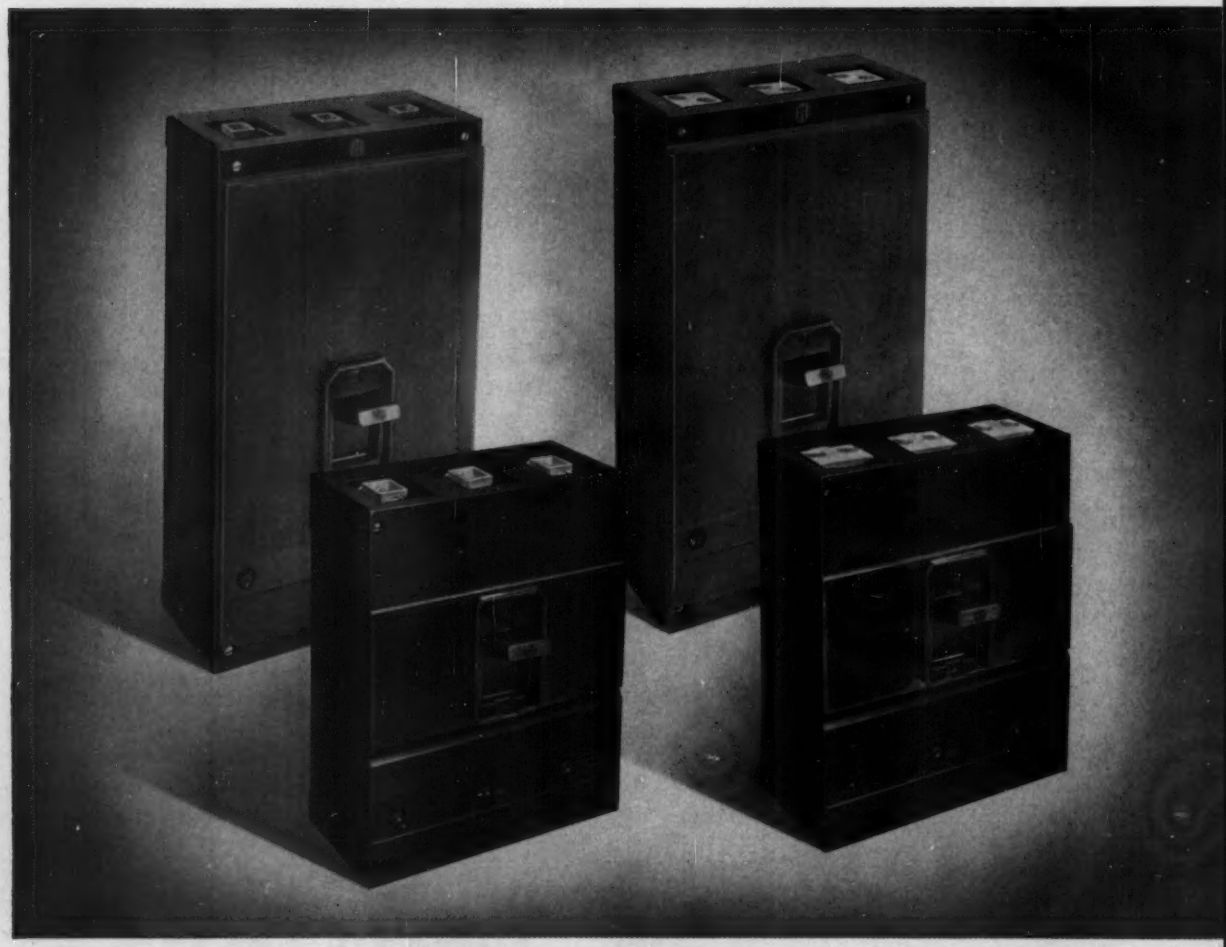

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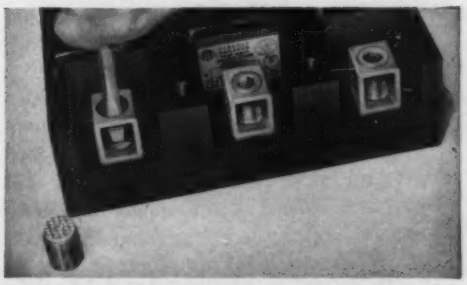

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Francis S. Friel

– *Starts on front cover*

firms in the nation, Friel believes "a man must develop his technical knowledge before he can advance professionally." This does not mean that a man should overlook his professional development, but that first he should be an expert engineer in the technical sense.

Friel speaks from experience. At various times he has devoted up to 75 percent of his working days to the engineering groups he deems so important to technical and professional growth. Besides serving as an officer on all levels of ASCE, Friel has been president of the American Institute of Consulting Engineers, the Federation of Sewage and Industrial Wastes, and the Pennsylvania Sewage Works Association. He also has served as chairman of the Pennsylvania Section of the American Water Works Association.

Additional Professional Groups

He is also a member of the American Concrete Institute, the American Public Works Association, the National Society of Professional Engineers, the American Public Health Association, the International Institute of Hydraulics Research, and the International Council on Soil Mechanics and Foundation Engineering.

In addition, Friel has represented the State Department and ASCE at many international meetings. Currently he is chairman of the U. S. Executive Committee for the International Commission on Large Dams (which will host the Sixth International Congress on Large Dams this month in New York), an alternate member of the U. S. Executive Committee of the World Power Congress, and a member of the board of directors of the Engineering Division of the American Road Builders Association.

In his spare time, Friel serves on the boards of trustees of Drexel Institute of Technology (his alma mater) and Trinity College in Washington, D. C. He also has just completed six years of service on the State Registration Board for Professional Engineers in Pennsylvania.

Unity through EJC

With all these activities, Friel understandably advocates unity in the engineering profession. And he believes wholeheartedly in the current ASCE policy aimed at achieving organization unity through the Engineers Joint Council. Instead of allocating the various technical, professional, and educational duties of the present engineering organizations as outlined in the AIEE functional plan, Friel thinks all organizations should retain all their present functions. EJC would be a coordinating agency, helping various groups avoid duplication of effort. EJC also could speak for America's 180,000 engineers who are members of its affiliated organizations – "a much-needed voice during the tidal wave of post-Sputnik technological development," he thinks.

According to Friel, "ASCE has no desire to impose its formula for unity on other groups. But a majority of engineers agree that unity is badly needed by the profession. All that is holding things up is agreement on the mechanics to be used to achieve this aim."

Friel feels there is a possibility of agreement during his term as ASCE president, if everyone can get together for frank discussion. "If I can help bring this about, I will feel my time has been well spent," he added.

If the EJC solution were accepted, would not engineers still be faced with the old, familiar problem – too many groups representing too many phases of the engineers' varied interests? No, says Friel. "Each man would choose the technical organization most important to him, and channel his efforts in that direction."

Unity through EJC is the answer to another problem, Friel pointed out. At a recent ASCE convention a proposal from the Consulting Engineers Council that a joint committee be formed to discuss common problems was turned down. "Cooperation between ASCE and CEC should come through EJC," Friel said. "If there is a problem common to any two engineering groups, it probably can best be solved by coordinating the efforts of these groups through EJC."

Money Matters

Another prime ASCE objective next year will be raising $800,000 for the new engineers' headquarters building. Already about 10 percent has been collected. The remainder must come from hard work in the various ASCE zones, districts, local sections, and subsections.

A top fund-raiser, Friel has established teams in ASCE Zone 2 where currently he is vice president. Similar teams have been established throughout the country by other vice presidents.

(Friel has had wide experience in fund-raising. He headed a project to collect $75,000 to help finance the Sixth International Congress on Large Dams. At last report, Friel was only $48.75 from his goal. And he helped raise $5 million for the Drexel Institute of Technology).

Technical Publications and Education

Pulling an organizational chart from his pocket, Friel pointed out the diversity of the ASCE tech-

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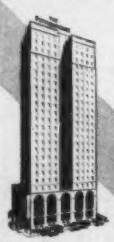

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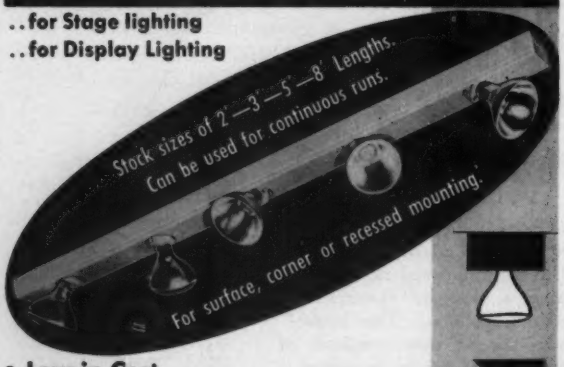

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nical activities. "We are proud of our history in technical publications," he said. "They are the backbone of our organization."

Friel wants to continue ASCE emphasis on technical work. Already, ASCE technical divisions have streamlined meetings. Fewer sessions are held, with many divisions contributing papers for a well-rounded coverage of a single topic. And Friel wants to further this trend.

Engineering Teacher Shortage

The many engineering education problems will receive attention during Friel's term of office. He plans a firm stand on adequate compensation for engineering teachers, hoping to stop the loss of top educators to industry. Friel strongly believes a teacher is needed more in school than in a plant.

The steady increase in the numbers of students entering college will require increased facilities and larger college budgets. "It is necessary, as I see it, for people who employ engineering graduates to put up the money to provide facilities for the ever-increasing student load," Friel said. "I must depend on colleges for technically trained men if I want to stay in business. Industry, consulting engineers, and other beneficiaries should lead in supporting the nation's engineering schools.

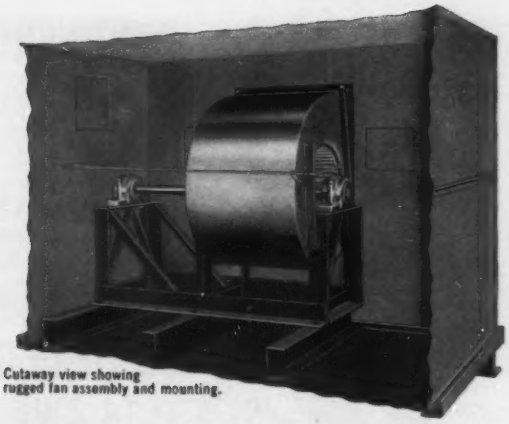
"There is no more dedicated group in the world than this nation's teachers. Many could make more money in industry than they can teaching, and they are well aware of this fact. I will do anything I can to improve conditions for them." As vice chairman of the Drexel board of trustees, he has been prominent in raising the school's teacher salaries until they are well above the national median wage, and he feels this should be done in every college.

Engineering Background

Friel inherits his interest in engineering from his grandfather John, who built one of America's early stone arch bridges near Hagerstown, Maryland. The bridge is still in use.

Friel decided he wanted to be an engineer when he was a small boy in Maryland. One summer he assisted an engineer who was surveying wooded plots. Young Friel carried the end of the surveyor's chain for 15 cents a day. He was fascinated with the work.

After graduating from Drexel in 1916, Friel went to work for Philadelphia's city engineer, Chester E. Albright. A few months later Friel was the first Philadelphia city employee to volunteer for service in World War I. As a first lieutenant in the 304th Engineers, 79th Division, 24-year-old Friel was recommended for the Distinguished Service Cross for preparing a path for French tanks across no-man's land. (In those days, tanks could barely ne-



Cutaway view showing rugged fan assembly and mounting.

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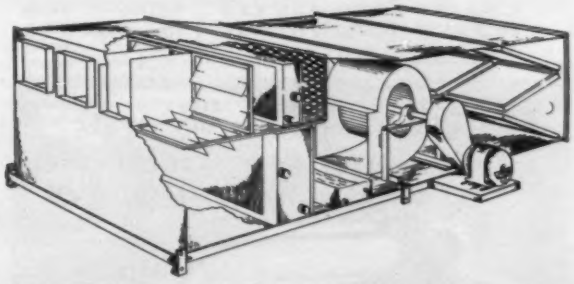

Still a pace-setter

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COLLECTS MIST-FOG EFFECTIVELY IN A SMALLER SPACE

This efficient Mistkop unit provides low-cost mist control for all machining operations employing coolants or lubricants. Requires no duct work or costly piping—*is actually portable!*

Mistkop is sturdy in design—has a minimum number of parts and gives long, trouble-free service. Stops clouding of lights . . . eliminates fire hazards of uncontrolled mist. Write for detailed description.

AGET Manufacturing Company
1378 Church Street • Adrian, Michigan

gotiate shell holes.) After the path was cleared, Friel led 250 French tanks through a barrage of machine gun and shell fire.

After the war Friel returned to Philadelphia and got a job with Albright, who had returned to his private consulting engineer firm. Albright had opened a consulting office in Philadelphia in 1890, specializing in design of water and sewer systems, land surveying, city planning, and location surveys and designs for electric railway systems. One of Albright's most unusual accomplishments was the inventing and patenting of the original roller coaster. Later he went to Europe as consulting engineer for the London Imperial Exposition.

In 1923 Friel was registered as an engineer and was issued one of Pennsylvania's first certificates. (Now he also is registered in New York, New Jersey, Maryland, Delaware, Virginia, West Virginia, North Carolina, and Ohio.)

After 10 years Friel was named a vice president of the firm, and in 1945 he became president of Albright & Friel.

Aberdeen Proving Ground

Although a civilian in World War II, Friel performed a task as unusual as leading tanks through no-man's land. Shortly after the Fall of France in 1940, Friel was called to Aberdeen, Maryland and shown a muddy cornfield and a contractor. He was given four months to prepare for 10,000 troops.

With a staff of 150, Friel spent the winter "in mud at least ankle-deep" planning and supervising construction of the Aberdeen Proving Ground. The camp included more than 600 buildings, a sewage treatment plant, a water supply system with filtration plant and storage facilities, fuel oil storage, refuse incinerators, outdoor transformer station, 12 central heating plants, more than 1.2 miles of underground steam distribution pipes, over 2.5 miles of railroads, 31 miles of paved highways, more than 19 miles of electric service lines, over 24 miles of sewer lines, and 20 miles of water lines. It was ready for occupancy within four months. Later Albright & Friel was called back to double the size of the camp.

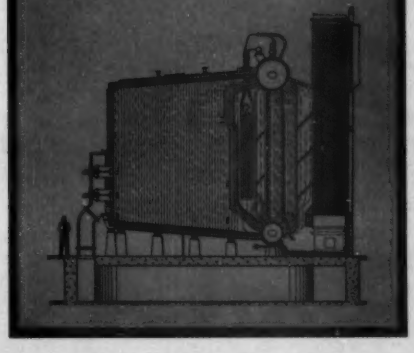
Long-Distance Water Supply

Another of Friel's favorite projects was the water supply system for Chester, Pennsylvania. Since Chester is on the polluted Delaware River, water supply was as much a sales as an engineering problem. Friel decided that the best water supply would be from Octoraro Creek, 38 miles away. "Never before had a city of this size gone so far at such cost ($14 million) to get water," Friel recalled. The profitable municipal water system, if built today, would cost Chester residents $22 mil-

C-E Boilers exceed guarantees at ANHEUSER-BUSCH, Inc.

The Newark, N. J., brewery of Anheuser-Busch, Inc. The seven year old power plant, left, is so spectacularly clean and neat that it has constituted a major attraction for professional and technical groups along the eastern seaboard. The popularity of these tours is such that, currently, reservations must be made two months in advance.

(Above) One of the two C-E Type VU-50-B, oil-fired boilers in the Newark brewery (cross-section below). Each has a maximum continuous capacity of 100,000 lb per hr and produces steam at 550 psi and 750 F. The floor in the foreground is chemically cleaned daily, polished twice weekly and completely refinished yearly.



In a brewery, the demands placed upon its boilers can be rigorous indeed. At the Anheuser-Busch brewery in Newark, New Jersey, they provide steam for power generation, for processing and for numerous high-capacity instantaneous water heaters used in various brewing and bottling operations. Since brewing is essentially a "batch" process, steam demands fluctuate sharply and continuously. Yet the C-E Boilers installed at Newark have consistently exceeded performance guarantees and operate at an efficiency of 86%.

Mr. Herman Paradies, Superintendent of Utilities at the Newark brewery, has stated that it is not unusual for steam demands to rise from 80,000 to 130,000 pounds per hour in ten to fifteen seconds, and that the boilers have responded with nominal loss in pressure or temperature. This enviable record, which speaks well both for boiler design and for the skills of the power plant's operating management and staff, is one of which Combustion is proud.

When *you* need boilers, remember that C-E has a complete line of time-tested and service-proved designs and that there is a size and type which will fit your needs and serve you equally well.

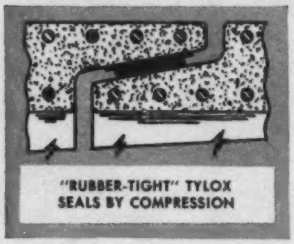
COMBUSTION ENGINEERING

Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.

C-164A

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

Leak-proof "for the life of the line"...



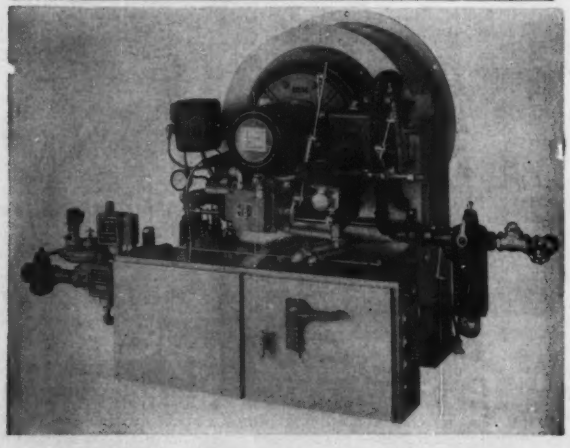
TYLOX
Rubber
PIPE
GASKETS

Heavy-duty, acid-resistant, *flexible* TYLOX Gaskets are made for large bore tongue and groove pipe. They are quickly "snapped on" to the pipe, and the pipe quickly coupled into the line. TYLOX reduces construction costs by speeding pipe coupling, and forms a compression seal that stays tight for the life of the pipe. TYLOX reduces treatment plant costs by preventing infiltration. REXON No. 2 PIPE COATING is a synthetic hard rubber which vulcanizes to pipe by catalytic action, *not* by evaporation which causes pin-holes. REXON No. 2 protects concrete pipe from deterioration by hydrogen sulphide gas, oils, greases and solvents. WRITE FOR MORE DETAILS.

HAMILTON KENT MANUFACTURING CO.

Kent, Ohio *ORchard 3-9555*

5103



JOHNSON Forced Draft BURNERS

For firing with Oil only . . . Gas only . . . or Combination Oil or Gas. Wired, tested and completely assembled at the factory ready for easy, inexpensive attachment to any boiler or heat receiver. They provide smoother, more efficient combustion regardless of stack conditions and firebox pressure variations. Powered by the famous Johnson Mod. 53 Burners, these "packaged" units are available for any heating need, in sizes from 25HP to 500HP.

Johnson Oil Burners

S. T. JOHNSON CO.

940 ARLINGTON AVE. OAKLAND 8, CALIF.

CHURCH ROAD BRIDGEPORT, PA.

lion. Since the water system was finished 10 years ago, Albright & Friel has been called back to add to the filter plant ("much of our business comes from former clients").

"Too Thick to Navigate"

And another of Friel's sensational projects was reclaiming Pennsylvania's Schuylkill River. Anthracite mines, at the head of the river, had dumped 30-million tons of coal silt into the Schuylkill. Described by *The Saturday Evening Post* as "too thick to navigate, too thin to cultivate," the river was clogged by as much as 22 feet of the silt. Friel was associated with three other consulting engineers on the desilting project, described by the governor of Pennsylvania as "the biggest project of its kind in the world."

In describing the project at the Fourth International Congress on Large Dams in New Delhi, India (where he represented the State Department and ASCE), Friel reported:

"We first constructed temporary dams so dredging equipment could be floated in the river. Then the silt was pumped into 22 basins located along the banks of the river. Each basin had a capacity of 1 to 2 million tons of materials.

"Several existing dams, constructed over 100 years ago for navigation purposes, were removed to facilitate the movement of culm deposits downstream to basins where dredging operations were carried out with shallow-draft floating dredges."

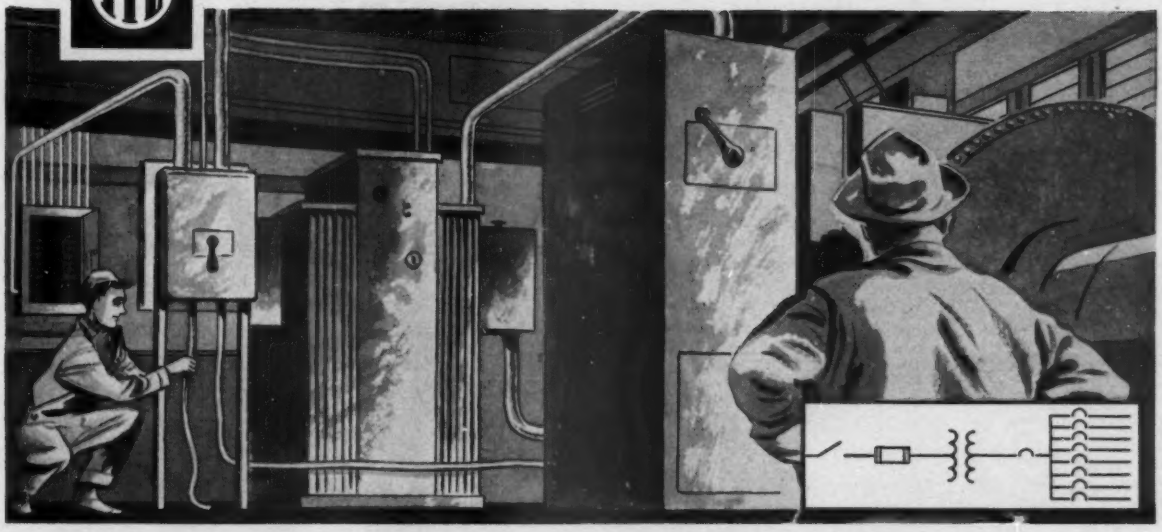
One proof of the project's success came during a heavy storm in 1950. The flood level in one city was five feet lower than it had been during an identical storm eight years before.

Over $1 Billion in Projects

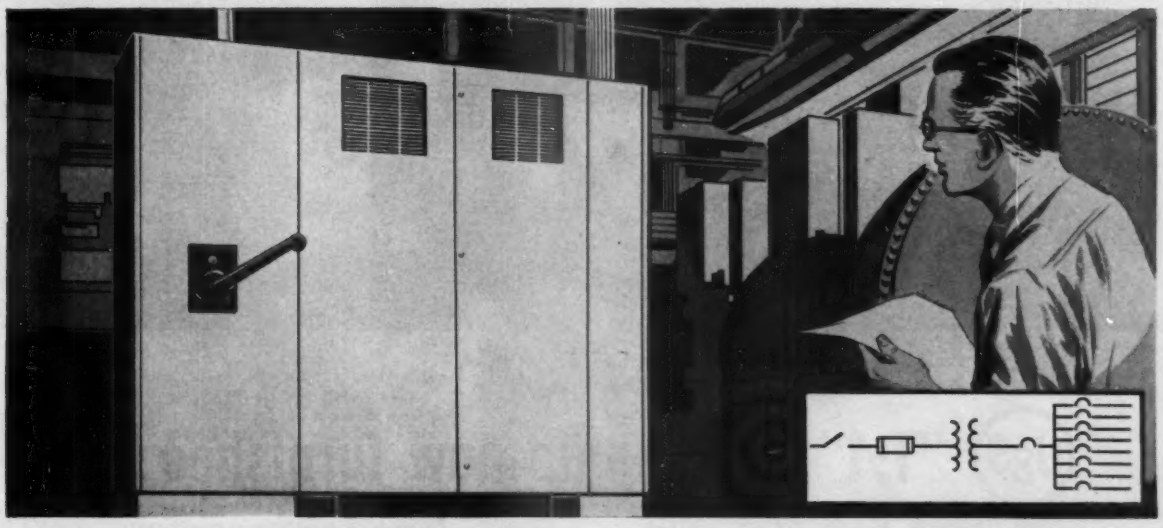
Altogether Friel has been in charge of more than 2000 projects during the past 27 years, with estimated construction costs exceeding $1.25 billion. Currently his firm specializes in water and sewerage systems, industrial wastes, incineration, city planning, highways, bridges, airports, flood control, dams, army and navy installations, and financial studies and reports.

Although Albright & Friel has confined its operations to the United States, Friel's own interests long have been international. He is on a team of consulting engineers investigating present and future needs of the Panama Canal. With a short-range program for canal improvements recently completed, the board of consultants is working on a blueprint for future canal needs. In fact, one of Friel's first official duties as ASCE president will be to preside at the ceremonies marking the Panama Canal as one of the ASCE-designated Seven Modern Wonders of Civil Engineering. ▲▲

TRANFO-UNITS



WHY BUY AN EYESORE?



A TRANFO-UNIT COSTS NO MORE

It's neat, compact and completely self-contained—a practical, economical way to bring in your electric power at the low-cost higher voltage. You get the transformer, primary disconnect, and secondary protective devices all included in one neat, safe package.

The I-T-E Tranfo-Unit costs no more than hodgepodge arrangements of assorted gear. But it's so much more satisfactory. You place one order . . . that saves time and trouble. It comes complete . . . that saves extra engineering. It's delivered in one piece . . . that saves installation labor.

For supermarkets, schools, office buildings, factories and many other applications, the I-T-E Tranfo-Unit is ideal. Available in a wide range of capacity ratings. Get all the facts now. Write I-T-E Circuit Breaker Company, Transformer & Rectifier Division, 19th & Hamilton Sts., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY
PHILADELPHIA, PENNSYLVANIA

USS "T-1" Steel Plate now furnished to 100,000 psi minimum yield strength

11% greater strength. USS "T-1" Constructional Alloy Steel can now be furnished to a minimum yield strength of 100,000 psi in plates up to 2½ inches thick. This is in addition to the present types of "T-1" Steel which are still available at a minimum yield strength of 90,000 psi. The new minimum tensile strength—the point at which actual breakage occurs when stressed in tension—has been increased from 105,000 to 115,000 psi. The published tensile strength maximum of 135,000 psi remains unchanged.

Weight reductions up to 50%—or more. Because of its great yield strength, three times that of structural carbon steel, USS "T-1" can be used to save weight in highly stressed members of bridges, TV towers and pressure vessels. Weight savings from 25 to 50% are common. For construction equipment, USS "T-1" Steel's strength, plus high resistance to impact abrasion, boosts payload capacity and increases equipment life.

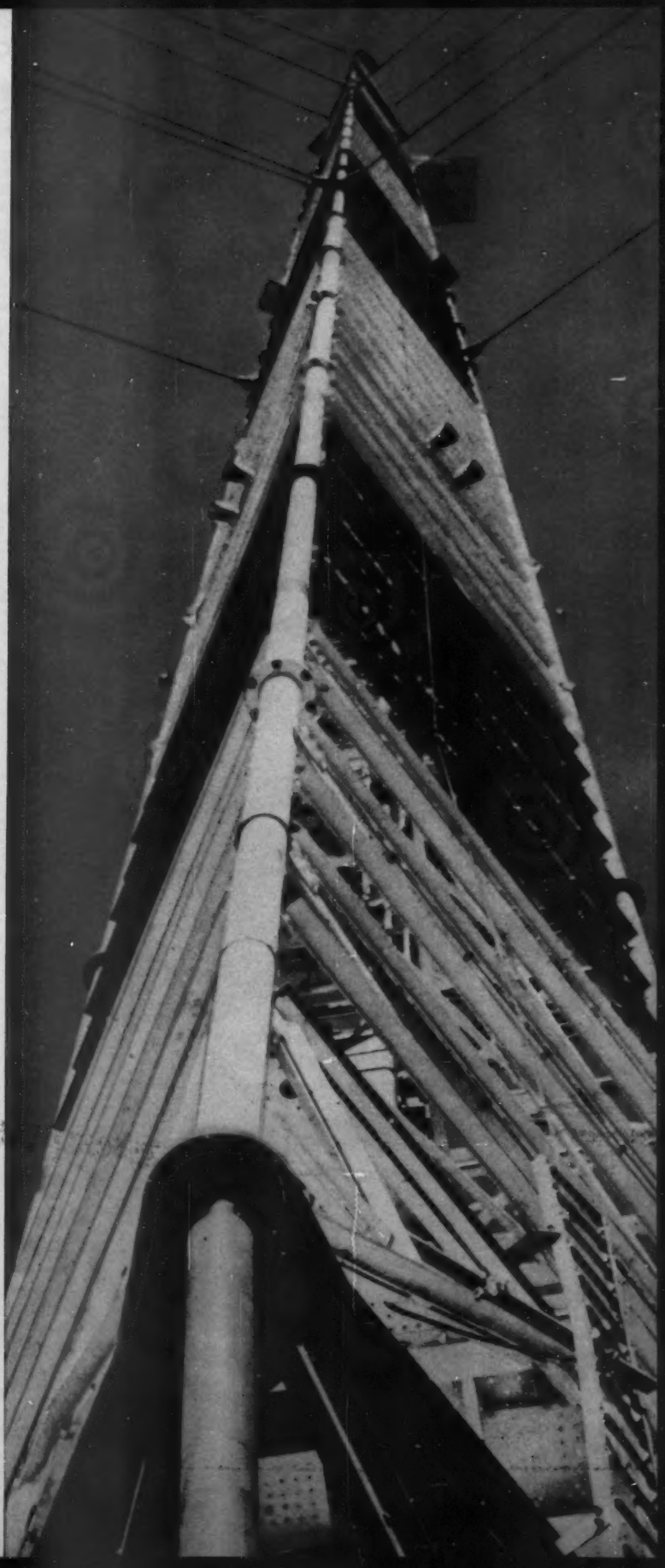
Cost savings up to 11%. The increase in strength at no extra cost amounts to customer cost savings up to 11%. Use of higher design stresses reduces the fabricating, welding and shipping costs because less material is needed.

The new strength data were arrived at after continuous tests on production lots of USS "T-1" Steel Plates at our Homestead Works. Actual experience confirmed the tests, and it became apparent that higher mechanical properties inherent in USS "T-1" Steel could be consistently developed. **Free book.** For complete technical information on USS "T-1" Steel, write to United States Steel, Room 2801, 525 William Penn Place, Pittsburgh 30, Pa.

USS and "T-1" are registered trademarks

USS "T-1" Steel saves $800,000. By using this stronger, weldable steel in the heavily stressed members of the New Carquinez Bridge in San Francisco, weight of some members was cut almost in half, with an overall savings of $800,000.

TV tower costs cut 15%. Because of its great strength, USS "T-1" Steel was used in the bottom 838 feet of this 1,199-foot TV tower. The cross-sectional area of the legs was reduced by 44%, resulting in a material and fabrication saving of 15%.

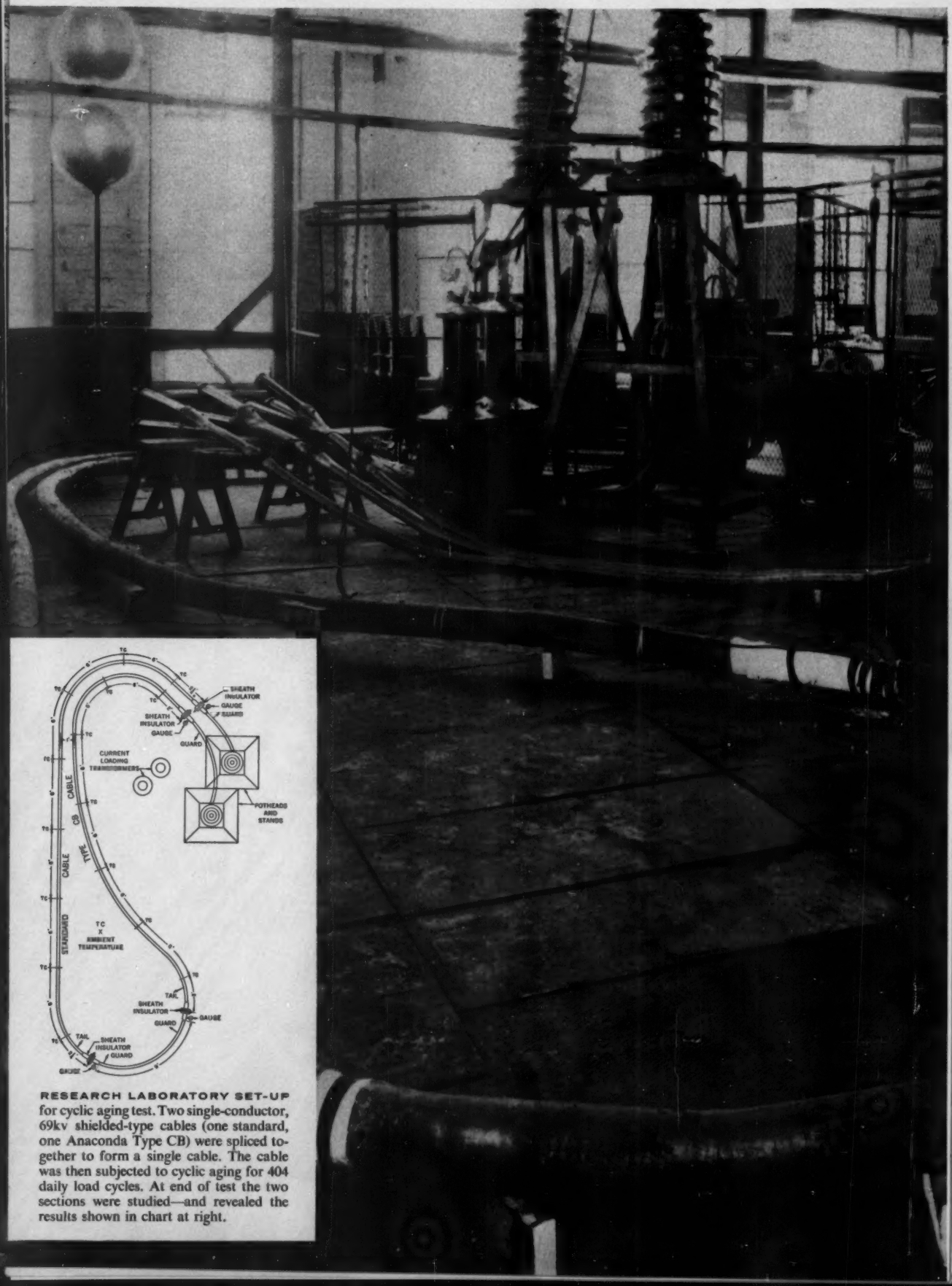


USS

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company

United States Steel

Cyclic aging test on paper-lead power cable reveals —



RESEARCH LABORATORY SET-UP for cyclic aging test. Two single-conductor, 69kv shielded-type cables (one standard, one Anaconda Type CB) were spliced together to form a single cable. The cable was then subjected to cyclic aging for 404 daily load cycles. At end of test the two sections were studied—and revealed the results shown in chart at right.

Greater insulation stability...longer cable life with TYPE CB cable

Heat and electrical stress . . . heat and electrical stress—keep it up long enough and insulating oil in ordinary paper cable breaks down.

Anaconda Type CB* (Carbon Black) power cable is different. Special carbon-black tapes continually purify and stabilize the insulating oil over the life of the cable. These carbon-black tapes provide many advantages:

1. Oxidation products are removed.
2. Deterioration is reduced by continuous purification of the oil.
3. Conductor is shielded; strand discharges, and ionization discharges between insulation and sheath are eliminated; maximum stress is reduced more than 25 percent.
4. Destructive energy is reduced because the work function of carbon is much less than that of copper.
5. Surge currents are diminished.
6. Impulse strength is increased.
7. Dielectric strength and life are increased.

The over-all result is not only physical and electrical improvements, but also real economic gains for the user.

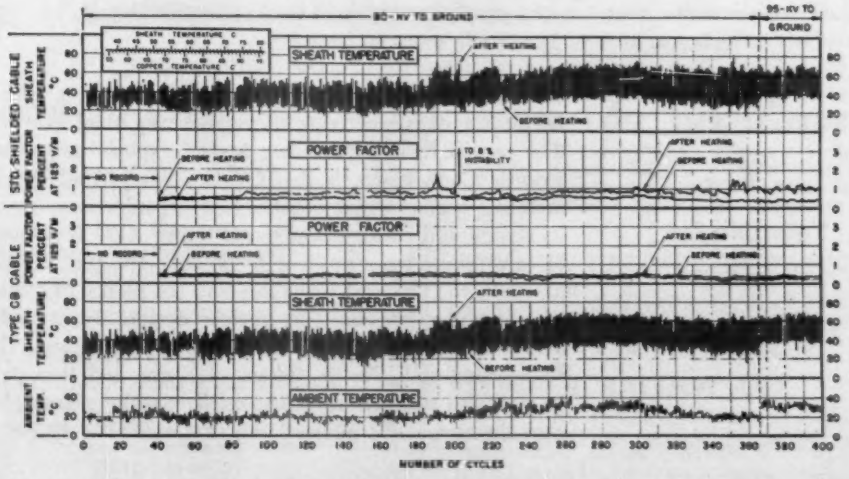
CYCLIC AGING TEST

For dramatic proof, no other test shows stability better than the cyclic aging tests.

The test shown here consisted of subjecting two single-conductor, 69kv shielded-type cables to cyclic aging for 404 daily load cycles. One cable was Type CB, the other a cable of standard construction. Both cables were still in operating condition at the end of the test. The standard cable, however, showed definite signs of aging. The Type CB cable showed no such signs.

WANT TO KNOW MORE? The Man from Anaconda will be glad to give you full information about Type CB cable. See him or write for Bulletin C-89. Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y.

*CB—Carbon Black (U. S. Patents 2,102,129; 2,405,853) Reg. U. S. Pat. Off.



CYCLIC AGING CHARACTERISTICS of 1/c, 650 Mcm, 69kv solid-type paper-insulated cable, standard construction compared to Type CB construction. Power factor readings during each cycle show low and constant values for Type CB cable—0.3 to 0.5 percent for both. The standard cable, with the same initial values, increased to over 1 percent at the end of the test. Power factor readings before and after heating during each cycle are also significant. At first, both cables show "after heating" values below those for "before heating." In the standard cable, the trend is reversed (69th cycle) and the "after heating" values are higher to the end. In the Type CB cable, the "after heating" values remain below throughout the test.

LIVE BETTER ELECTRICALLY

SEE THE MAN FROM **ANACONDA**®

FOR **TYPE CB CABLE**

The Reader's Guide

Engineered Structures

When designing conventional structures it is generally clear which part of the work is architectural and which part engineering. But when the design becomes one of prefabricated panels, thin shells, cables, and cantilevers, the work of the engineer and the architect combine into an indivisible whole. The engineer for these modern structures cannot be looked upon as a "beam sizer," for the very shape of the structure depends upon the solutions to stress equations and strength of materials calculations. Fred N. Severud, of Severud-Elstad-Krueger, is an engineer who has dealt intimately with architects on new types of structures for a number of years. Just two months ago he received the 1958 Allied Professions Medal from the American Institute of Architects. He discusses some of his ideas for structural design in a well-illustrated article that starts on page 88. The examples Severud selected represent buildings recently constructed or now in the design or planning stage.

The First World's Fair

World's fairs are good capsule representations of social, economic, and technological life in the participating nations. The Brussels Fair, for example, illustrates Russia's preoccupation with technological progress and our own country's desire to display a way of life that, while scientifically advanced, is no longer exclusively attracted by the dollar and what it will buy. No matter what is displayed or what effect is attempted, world's fairs are still primarily exhibitions of engineering developments. The Brussels Fair is; so was the first of the great international expositions held in the Crystal Palace, in London, something over a hundred years ago. Engineers will be interested not only in the products displayed in the Crystal Palace but also in the attitudes toward science and technology of those who reported the London Exhibition. Where Brussels almost apologizes for the state of modern science, London, in 1851, felt confident that machine technology soon would make possible a world of permanent peace and prosperity. Dr. Thomas Hughes, of the History Department, Washington and Lee University, has done a vast amount of research on the London Exhibition, particularly its technical aspects. His article starts on page 98.

Your Nuclear Engineers

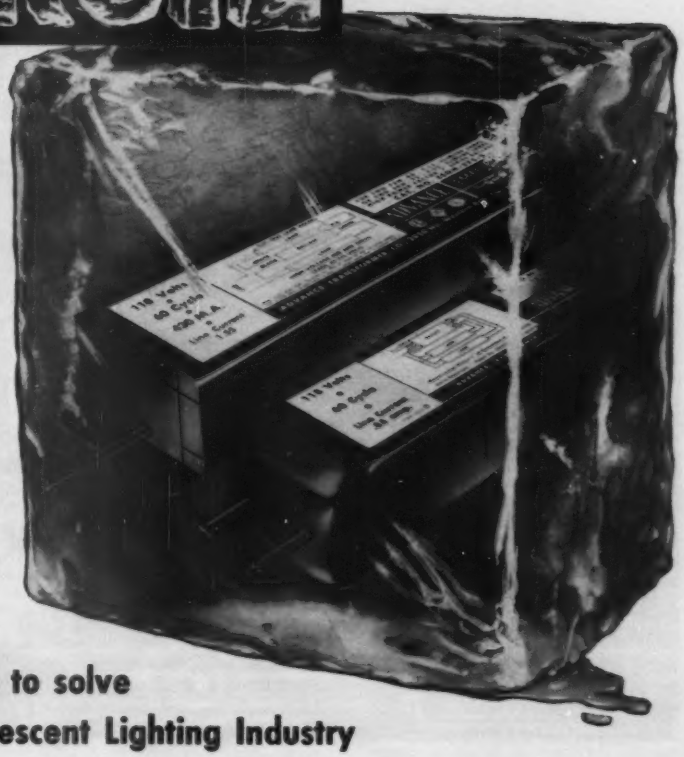
The Atomic Energy Commission reports that it spends a smaller percentage of project construct costs on engineering than any other government agency. The reason their engineering is so inexpensive, according to a report of The Hoover Commission, is that "AEC takes full advantage of services of private architect-engineer and construction organizations by contracting all phases of its design and construction work." Since AEC is saving money through the use of consulting engineers, it is to be expected that the Commission will continue to use them. The next few years will see plenty of work for consultants who are trained and experienced in nuclear design. Burns and Roe has been engaged in this work for some time, and it has built up a highly respected nuclear engineering staff. Dr. S. Baron, of Burns and Roe, tells how his firm trained its staff and suggests ways in which consulting firms, large and small, can prepare themselves for nuclear project design. His article starts on page 106.

Aluminum Conduit

Sam Starr and Frederick A. Rode, of The Firm of Edward E. Ashley, Consulting Engineers, recently completed an excellent report on the current status of aluminum conduit for electrical distribution systems. A new, lower price range for aluminum conduit makes it competitive with steel in the larger sizes. The authors condensed the report somewhat, emphasizing those portions of most importance to consulting engineers, and submitted it to us for publication. It contains important price and specifications data, and it should be of considerable practical value to our readers. It starts on page 114.

ADVANCE KOOL KOIL

REVOLUTIONARY NEW FLUORESCENT LAMP BALLASTS FOR SLIMLINE AND RAPID START LAMPS



Here's what KOOL KOIL will do to solve the heat problems of the Fluorescent Lighting Industry

1 LOWER CONDENSER TEMPERATURE

Advance engineers recognized the fact that to end costly condenser trouble due to ballast overheating required both design and component changes. They designed the KOOL KOIL Rapid Start case to allow a greater separation of condenser and coil. They tested new grades of steel, wire, insulation and compounds and after three years developed Kool Koil, the only ballast under comparative tests that did not overheat to temperatures exceeding the capacitor manufacturer's 70° C warranty limit.

2 LOWER WATTAGE LOSS

The efficiency of KOOL KOIL Ballasts (as much as 20% less wattage loss) offers Fluorescent lighting users a saving in operating costs and the manufacturer an opportunity to increase the efficiency of its units. The higher efficiency of KOOL KOIL (up to 15% more light output) enables the user to achieve the same illumination levels with 7% fewer fixtures.

3 LOWER COIL TEMPERATURE

Under actual operating conditions in a surface-mounted, 4-lamp, fully enclosed unit the maximum coil temperature of KOOL KOIL Ballasts tested was 17° C cooler than Ballast "A" and 22° C lower than Ballast "B".

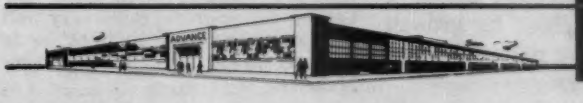
4 LOWER CASE TEMPERATURE

Operating in a 6-lamp recessed glass-bottom troffer, the ADVANCE Series-Sequence Ballast (RSH-2E75-S) case temperature was 18° C lower than Ballast "B" and 15° C lower than Ballast "A".

5 LONGER BALLAST LIFE

KOOL KOIL Ballasts practically eliminate ballast replacement. For every 10° C increase in case temperature over the maximum 90° C U/L limit, ballast life is cut in half. By operating with case temperatures 15 to 20 degrees cooler than ordinary ballasts, ADVANCE KOOL KOIL Ballasts give 3½ to 4 times longer life.

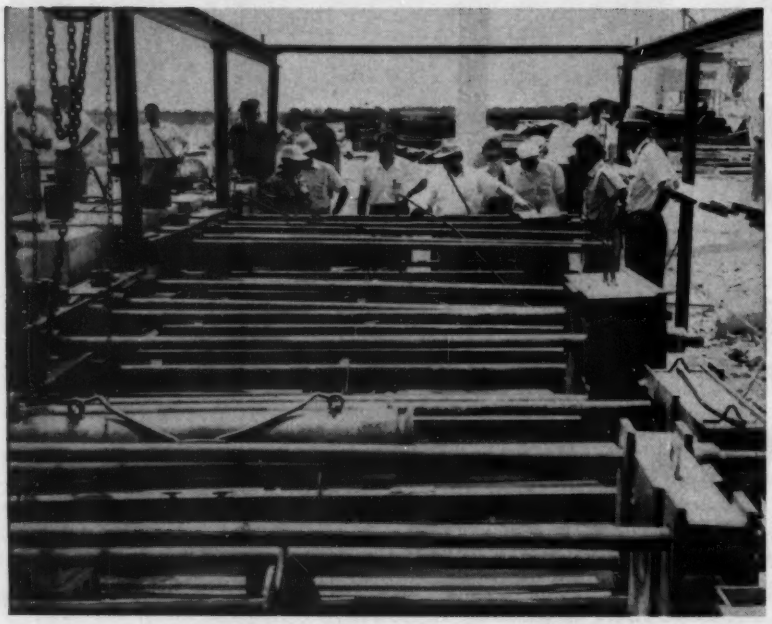
"The Heart of the Lighting Industry."

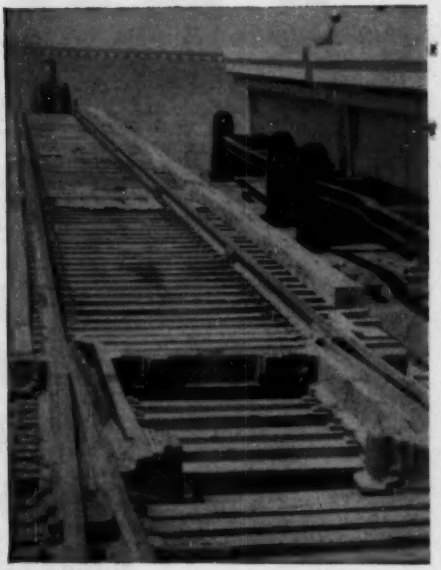


ADVANCE TRANSFORMER CO.

World's Largest Exclusive Manufacturer of Fluorescent Lamp Ballasts

This Amazing Prestressed Concrete Industry





What Is Behind Its Phenomenal Growth?

This is a question which has been asked many times. Union Wire Rope Corporation has answered with the sound reasons for venturing a huge capital investment in expanded facilities and in research to master the technical know-how of producing prestressed, stress relieved, high tensile wire and strand. Without this key element prestressed concrete would still not be possible and practical.

To check our own reasons and to develop all of the fundamental facts responsible for the spreading use and acceptance of prestressed concrete,

We Asked A PANEL OF PIONEERS In the Prefabrication of Prestressed Concrete Members To Summarize the Facts Which Has Enabled Them To Maintain a Yearly Growth of 200 to 300 Percent.

What follows is straight from the horse's mouth. It is a summary of the fundamental facts contributed by a sizeable group of prestressed fabricators and consultants. All are pioneers who have had a part in the development of prestressed concrete and experienced its growth from a trickle five years ago to become the building material to be reckoned with by every factor in the building industry.

Here Is a List of Prestressed Products Which A PANEL OF PIONEERS Are Prefabricating

Girders

Roof Slabs
Regular, Lightweight, Lift, Channel, Thin shell, Hollow centers, Composite.

Beams
Joists
Trusses
Columns

Piles and Caps
Foundation, Marine, Fender

Lintels
Wall Panels
Siding
Posts

Pavements
Highway, Airport

Stadium
Framing, Seats

"Future Applications of Prestressed Concrete Beyond Prediction"

These are the words of one and the consensus of opinion of others on our panel of pioneers. Other prestressed concrete products mentioned as either being prefabricated or tested and proposed are:

- Missile Wings
- Barges
- Transmission Line Supports
- Piers
- Seawalls
- Wharfs
- Arches
- Skews
- Spring Board—For Swimming Pools
- Off-shore Drilling Piles
- Platforms

While some of these may seem novel, many will become commonplace. Prestressing concrete for barges, for example, could very well become an industry in itself as is the prefabricating of bridge members.

PANEL OF PIONEER Prefabricators Cite These Outstanding Prestressed Concrete Advantages...

1. Fully Utilizes Two Inherent Strength Factors

Prestressing combines and enhances the inherent characteristics of two of the foremost construction materials—

A. The compression strength of concrete with

B. The high tensile strength of stress relieved cold drawn steel wire and strand.

2. Basic Economy

A. Steel for prestressing is six times stronger than ordinary steel but only approximately 3 times more costly.

B. Concrete for prestressing is twice as strong but only 10 to 20% more costly than ordinary concrete.

C. Prestressing consumes less steel and concrete to attain equal or greater structural strength more economically.

3. Structural Balance

A. In prestressed concrete, stresses and strains are balanced to produce structures whose deflections are under definite control.

B. Cracks, otherwise unavoidable in concrete, are eliminated by prestressing.

4. Design Economy

A. Prestressed concrete makes possible thinner sections, lower depth to span ratios, longer cantilevering without ballast beams and reduction in weight. All of these factors enable the designer to effect savings in foundation, in columns, in wall height or to convert head room into usable cubage.

B. Steady progress in standardization of sections under the auspices of the Prestressed Concrete Institute is making prestressed concrete more and more versatile from the standpoint of designers.

5. Prestressing Is Pre-Testing

A. Because they are subjected to greater loads in fabrication than is imposed upon them in the field, precast, prestressed members are in reality pretested.

B. Produced by factory methods, under closely controlled conditions, prestressed concrete guarantees the designer structural performance to meet or better expectations and affords relief from extensive supervision and inspections.

6. Stock Pile Availability

A. Factory line production methods with time saving devices insures delivery of prestressed concrete members from the production line in step with contractors work schedules.

B. Production of prestressed sections proceeds at top speed, affording maximum utilization of labor and stockpiling against projected construction.

C. Prestressed concrete eliminates construction delays by by-passing materials in short supply or on extended backlog delivery.

7. Speeds Up Construction

A. Construction by the older, conventional methods involves both erection and fabrication on the job site.

B. The latter is accomplished much faster in central plants or on the site mechanized plants and the resulting prefabricated units are erected with clock-like precision.

C. Often it is possible to complete structures in half the time required by conventional methods. It is often possible to erect prestressed concrete in the time required to make, place and shore up forms for poured in place concrete.

8. Permanence of Concrete—Plus

A. Well known is the durability of concrete. Well known too is its vulnerability to cracking. Cracks lay it and its reinforcing open to deterioration.

B. Prestressing makes concrete a flexible material with the ability to withstand extraordinary deflection and recover without cracking.

9. Insurance Savings

Comparison of insurance premiums are reported on new buildings with prestressed concrete roofs as against old buildings with wood roofs. Roughly the yearly premium on the latter is more than for 5 years on buildings with prestressed roofs. Though this is a comparison of extremes, it is indicative of how prestressed construction is regarded by insurance companies.

10. Economy of Maintenance

A. Even in marine construction or in construction subjected to other extreme corrosive conditions, the cost of maintenance on prestressed concrete construction ranges from nil to the expense involved in painting in cases where color is desired.

11. Widely Competitive

A. The initial cost of prestressed concrete is such as to enable its prefabricators to successfully bid against the permanent, fire resistant, all-weather types of construction in many types of structures.

B. When the collateral economies effected by prestressed concrete, such as greater and more flexible strength for longer spans and fewer columns, balanced stresses and strains and controlled deflection, thinner sections, lower depth to span ratios, lower wall heights and increased usable cubage, ready availability, speedier erection, negligible maintenance and lower insurance premiums are considered, then the competitive edge is definitely on the side of prestressed concrete for a growing list of structures.

So goes the summary of the thoughts of a panel of pioneers except for a warning which was sounded: Be sure of adequate capital and technical guidance when venturing into the business.

Stress-Relieved Wire &
Strand For Prestressed Concrete 4

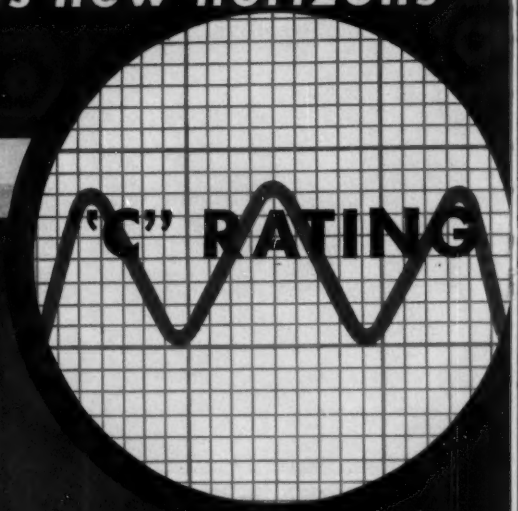
union Wire Rope corporation

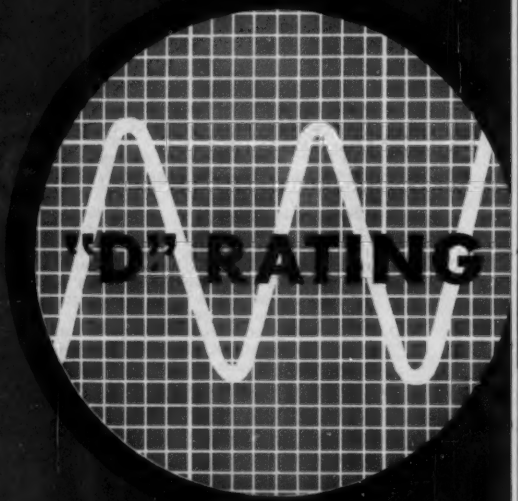
SUBSIDIARY BMC STEEL CORPORATION

2308 Manchester Avenue Kansas City 26, Missouri

Specialists in high carbon wire, wire rope, braided wire fabric, stress relieved wire and strand.

G-E ballast design opens new horizons





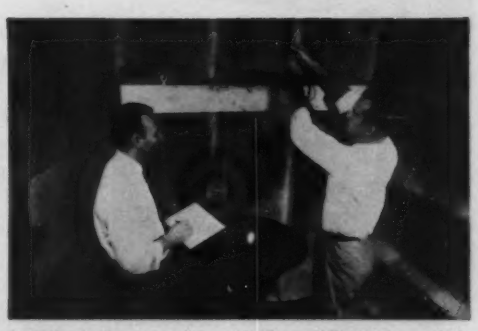
New G-E ballast brings "C" sound rating to 800 MA applications

new General Electric 6G1140 ballast is two sound ratings quieter than any "E" rated ballast for two 96T12/HO rapid-start lamps

The demands of lighting progress have again been answered by ***the leader*** in the ballast industry. General Electric engineers have effected reductions in size, operating temperature, weight, and sound level in designing the new 6G1140 ballast. The new 6G1140 is two sound ratings quieter than any "E" rated high-output rapid-start ballast on the market, and operates at less than 90 C in a two-lamp, eight-foot, louvered commercial fixture, surface mounted against an acoustic tile ceiling. This latest development in ballast progress is the result of two specialized General Electric facilities:

In General Electric's modern sound testing laboratory, engineers perform actual sound tests in an anechoic chamber designed and developed by G-E engineers exclusively for ballast testing. General Electric's investment in laboratory equipment has led to a complete ballast sound rating system that has been adopted by the ballast industry. The copyrighted G-E Ballast Sound Rating Calculator helps you select the proper rating to satisfy the sound requirements of every installation.

G.E.'s fixture test laboratory is believed to be the only one of its kind in the ballast industry. Lamps, fixtures, and ballasts are tested together in a controlled, draft-free ambient of 25 C, without heat dissipating devices. Thermal measurements are taken only after the ballast has reached a stable operating temperature. G-E heat measurements reflect actual, modern operating conditions. You get lamp-matched ballasts from General Electric.



Actual sound tests, performed in General Electric's anechoic chamber, help G-E engineers develop lamp-matched ballasts to answer the needs and demands of lighting progress.

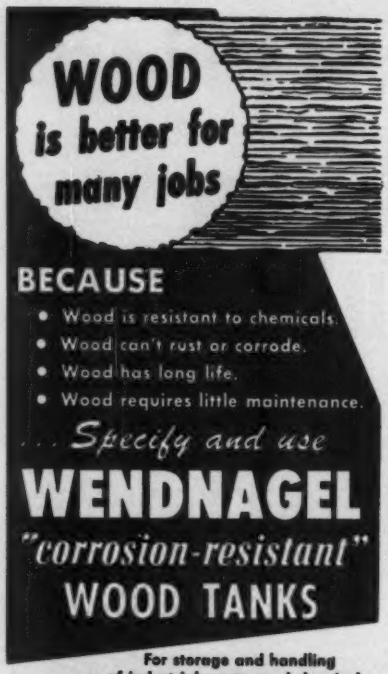
Each fluorescent lighting application is accepted as a separate challenge by General Electric engineers who know there is no one ballast that will act as a solution for all lighting problems. The new 6G1140 ballast is another example of General Electric leadership in ballast progress . . . another example of General Electric's OPERATION UPTURN . . . extra value for your ballast dollar. *Section 401-69, General Electric Company, Schenectady 5, N. Y.*

1958 GENERAL ELECTRIC BALLAST PROGRESS		
NEW 6G1020 operates at LESS THAN 90 C in four-lamp 40-watt T12 fixtures	NEW 6G1140 brings "C" SOUND RATING to two-lamp 96T12/HO-RS applications	WATCH FOR NEW BALLAST PROGRESS FROM GENERAL ELECTRIC . . . the leader in the ballast industry

OPERATION upturn — Buy now for extra values — GENERAL ELECTRIC

Progress Is Our Most Important Product

GENERAL ELECTRIC



For storage and handling of industrial wastes and chemicals.

Battery of Sludge Filters — Wood parts were furnished by Wendnagel. Nothing will take the place of WOOD for long life and low maintenance.

An example of Wendnagel engineering and construction for special applications — Multi-Stage Gas Scrubber for elimination of acid vapors and gases-furnished to requirements.

Send for new bulletin on use of Wood Tanks for chemicals.

Wendnagel & Co., Inc.

610 W. Cermak Road
Chicago 16, Ill.

Readers' Comment

Fair Profit at Three Percent

Sir:

Concerning your article "Dealing with the Architect Client" in the July issue:

It is a good report. However, one thought occurred to me after reading it – for whom was it written? We as consulting engineers know and have known these facts for a long time. The architects that may read it will dismiss it with a wave of the hand.

The paragraph in which it is stated that 20 to 25 percent to the architect and 75 to 80 percent to the engineer would be fair left me speechless. I always have believed that everybody should be rich, handsome, and happy; that all women should look like Ava Gardner; and that taxes should be reduced. It is all too true that we must be content with something less than these utopian dreams. Unfortunately, we will, of necessity, have to deal with things as they are and not as we would like to have them.

In this, the southeastern area of the United States, it has been and is now the fairly general practice that the architect receives (or retains) 50 percent and the consulting engineer receives 50 percent. I suspect that, with minor variations, it is sadly enough true of other areas of the country.

Please do not misunderstand this letter. I am very definitely in favor of that which you suggest. Just one point – in the same paragraph you state, "Meanwhile engineers should refuse to work for architects for fees that are too low to permit competent engineering." We, in this office, have a minimum of 3 percent for plans and specifications and any time that we demand 75 percent of the total fee or 4½ percent of the 6 percent of the architect's fee – we are going to be without work! We can and are making a fair profit on 3 percent. It may come as a shock but there are firms willing and even anxious to do it at less than 3 percent.

A Consulting Engineer
Tennessee

Contingent Fees

Sir:

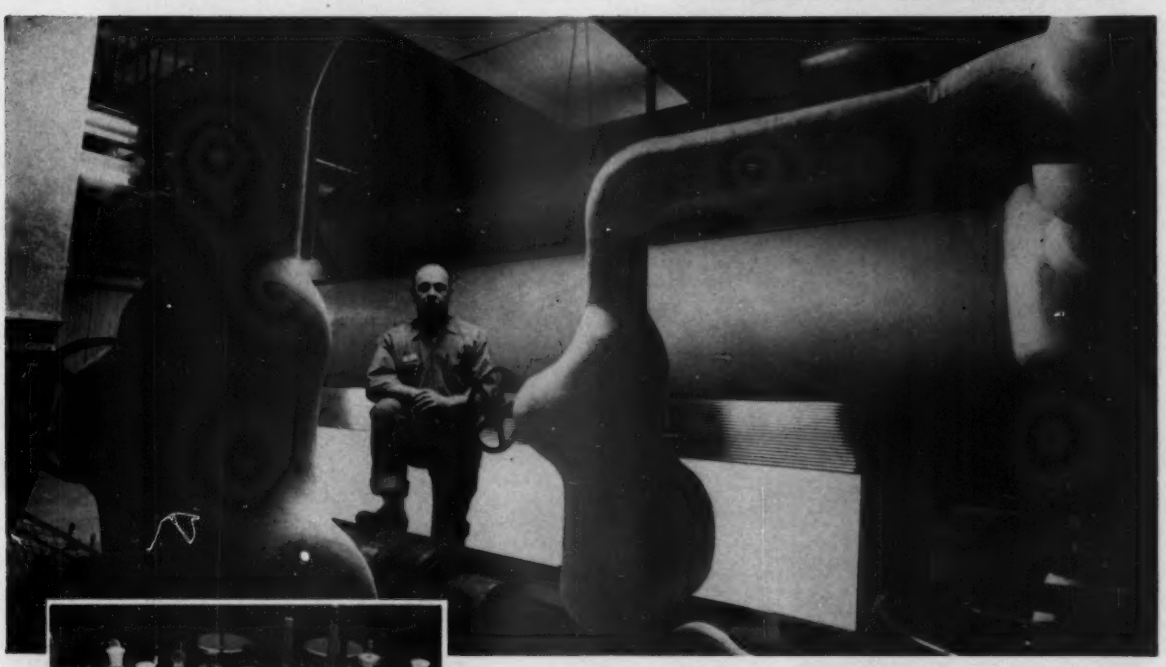
Reference is made to the article "Report from the West Coast" in your June issue, and to John A. Blume's comments in the July issue.

The specialty of our small firm is water resources development projects of all kinds. Our capabilities include preliminary investigations, feasibility studies, design, and supervision of construction for

This is National Aluminate Corporation, near Chicago . . . an industrial chemical company that provides industry with water and petroleum treatments and related facilities.

Gas-fired Carrier Automatic Absorption Refrigeration

- cuts operating expense
- lowers installation cost
- provides quiet, vibrationless operation
- answers space and weight problems
- automatically adjusts to varying loads



"Now we have trouble-free, economical cooling . . . thanks to our GAS-fired CARRIER absorption refrigeration"

JOSEPH HUBEK, National Aluminate

"Our new 340 ton capacity gas-fired Carrier Absorption Refrigeration unit now provides cooling for our general office and laboratory. At present we're cooling over 100,000 square feet, effectively and economically."

Put your heating system on a year 'round paying basis.

The absorption refrigeration unit makes use of one of the oldest and most reliable principles of refrigeration. No prime mover is required, only low pressure steam or hot water. Seasonally idle or excess boiler capacity can be put to use on a year 'round paying basis. With gas as the boiler fuel, operating costs are cut to a minimum. This gas-fired Carrier machine operates without noise and vibration . . . and because it is so compact and light weight, it can be put almost anywhere – from basement to roof.

This is only part of the story of the efficiency and economy of specifying gas-fired Carrier Automatic Absorption Refrigeration equipment. Specific performance, engineering data and cost details on the economy of gas refrigeration are yours for the asking. Just call your local gas company, or write to the Carrier Corporation, Syracuse, New York. *American Gas Association.*

dams, hydroelectric plants, irrigation works, etc., and our principals have devoted most of their engineering careers to this work.

However, in spite of our qualifications, we have recently lost work to other larger firms, whose proposals have been made on a contingent fee basis. In one case, one of these large firms, which never before had engaged in the hydroelectric engineering business, was able to employ several qualified engineers for the promotional work, and succeeded in obtaining a contingent fee contract.

Our firm was extremely interested in obtaining this work, but we do not have a quarter of a million dollars to invest in such a speculative deal. Therefore, we are slowly but surely being strangled by the larger and richer firms. The unfortunate part of this situation seems to be in the fact that, in these cases, an engineering firm is selected for its ability and willingness to invest money in a speculative venture, and may or may not be well qualified to perform the work involved.

While we regard contingent fee contracts as objectionable from the viewpoint of engineering ethics, it is apparent that there is little we can do about it. The principals of some of these large firms are well known members of such societies as ASCE. Some can offer sufficient financial contributions to other organizations to attain widespread publicity so that their names become well known.

At present, it appears that small engineering firms in this area are doomed by the large firms who furnish the money required as well as engineering services. We wonder how many questionable projects will become economically justified (on paper) and widely publicized so that the contingent fee boys can collect their juicy fees?

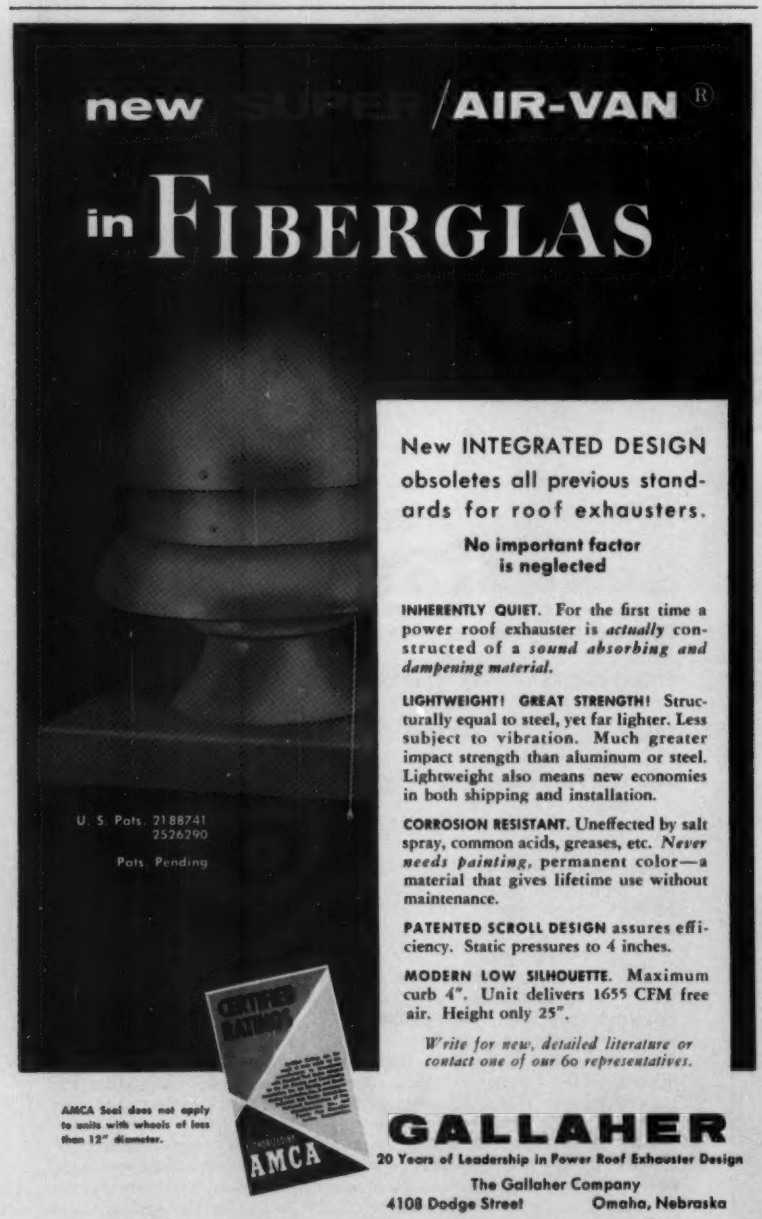
L. A. Hostetter, Vice President
Bleifuss, Hostetter & Associates
Sacramento, California

Canadian Consultants

Sir:

I have just read with interest the article "Canadian Consultants Complain of U. S. Competition" in your July 1958 issue. It may be that we are farther from the problem, or the source of this discussion than some, but we have provided professional engineering services on a number of Canadian projects and have many friends in Canada and have not heretofore heard of this complaint. Therefore, we were surprised at the reaction by some of the Canadian engineers.

For one thing, we are glad that the border or "frontier" between us and our good Canadian neighbors is no more of an obstacle for professional people and their services than it is for the tourists. It is felt this free interchange of work, services, and ideas is to the mutual benefit and development of both our nations. We know of little re-


new SUPER/AIR-VAN®
in FIBERGLAS
New INTEGRATED DESIGN
obsoletes all previous standards for roof exhausters.
No important factor is neglected
INHERENTLY QUIET. For the first time a power roof exhauster is actually constructed of a sound absorbing and dampening material.
LIGHTWEIGHT! GREAT STRENGTH! Structurally equal to steel, yet far lighter. Less subject to vibration. Much greater impact strength than aluminum or steel. Lightweight also means new economies in both shipping and installation.
CORROSION RESISTANT. Uneffected by salt spray, common acids, greases, etc. Never needs painting, permanent color—a material that gives lifetime use without maintenance.
PATENTED SCROLL DESIGN assures efficiency. Static pressures to 4 inches.
MODERN LOW SILHOUETTE. Maximum curb 4". Unit delivers 1655 CFM free air. Height only 25".
Write for new, detailed literature or contact one of our 60 representatives.
U. S. Pats. 2188741
2526290
Pats. Pending
AMCA
AMCA Seal does not apply to units with wheels of less than 12" diameter.
GALLAHER
20 Years of Leadership in Power Roof Exhauster Design
The Gallaher Company
4108 Dodge Street Omaha, Nebraska
*TM Owens-Corning Fiberglas Corporation

longer, stronger AMVIT Jointed Clay Pipe prevents infiltration SIX WAYS

Bottletight, Factory-Made Joint of Plasticized Resins of Polyvinyl-chloride gives lower cost-in-place

Engineering standard and specifications for sanitary sewers are written so that both the contractor and the community can obtain the best type of construction.

They limit the amount of infiltration in sewer pipe joints, which, in turn, reduces pumping and treatment plant costs. Amvit* Jointed Clay Pipe was especially designed to achieve best possible results.

1. FACTORY-MADE QUALITY

The Amvit Joint is manufactured from plasticized resins of polyvinyl-chloride. No other combination of materials is used or needed. It is applied on the pipe by a special manufacturing process and delivered to the job site ready for immediate installation.

2. DESIGN PREVENTS LEAKS

The Amvit Joint is a compression type joint based on the ball and socket principle. The material on the spigot end is a convex shape, with the bell end in a concave shape. Simply pushing the pipe together "makes" the joint, keeping the surfaces of the bell and spigot rings in constant compression. Thus, infiltration, exfiltration, and root penetration are prevented.

3. QUICK, FOUL-PROOF INSTALLATION

The joint is on the pipe delivered to the job site ready for immediate installations. No other materials such as caulking, joint compound, hot pots, or ladles are needed to make the Amvit Joint.

4. PERMITS DEFLECTION, ABSORBS SHOCKS

Amvit is made from a plastic which has many characteristics similar to rubber. It is pliable, permitting deflection without leakage. It is resilient, can absorb shocks, and vibration.

5. BETTER FLOW, LESS MAINTENANCE

The design of the joint assures that the pipe is self-centered at all times. This gives perfect alignment and self-cleansing action. Because the joint is really tight, no foreign matter such as dirt, sand, or stones can possibly enter the line.

6. COMPLETE FITTINGS

Amvit is furnished on all standard fittings, as well as pipe. This will permit a uniformly tight line from house to treatment plant.

Amvit Jointed Clay Pipe, in sizes 4" through 24", together with all fittings is available for immediate delivery in the Northeast and Central States.

For more information on how Amvit can help cut your sewer installation costs, write or call American Vitrified Products Company, National City Bank Building, Cleveland, Ohio, or our office nearest you, for this descriptive folder.

SINCE 1848

AMERICAN

American Vitrified Products Company

CLEVELAND OHIO

*T. M. Registered

PLANTS ACROSS THE NATION . . . Brazil, Indiana • Chicago, Illinois • Cleveland, Ohio • Crawfordsville, Indiana • Detroit, Michigan • East Liverpool, Ohio Fenton, Michigan • Grand Ledge, Michigan • Lisbon, Ohio • Los Angeles, California • Milwaukee, Wisconsin • South Bend, Indiana • St. Louis, Missouri • Whitehall, Illinois

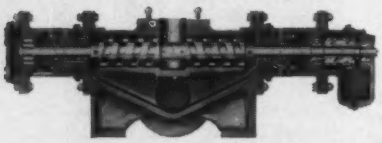
Louisiana Power & Light Company (Ninemile Point Station)

relies on *Sier-Bath* SCREW PUMPS

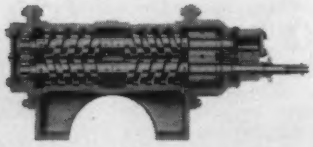
for emergency fuel oil service

● At this ultra-modern, natural gas-fired Ninemile Point steam-electric plant, two heavy-duty Sier-Bath Screw Pumps are installed for standby emergency fuel oil service in case of failure in the gas supply. The screw pumps are external gear and bearing type, having a capacity of 175 gpm. pumping Bunker C oil at 120° F., with a viscosity range of 3,000 to 40,000 SSU, discharging at 215 psig. with a maximum flooded suction lift of 16 feet.

Sier-Bath **SCREW PUMPS**



External Gear and Bearing Bracket Type for non-lubricating liquids and semi-liquids



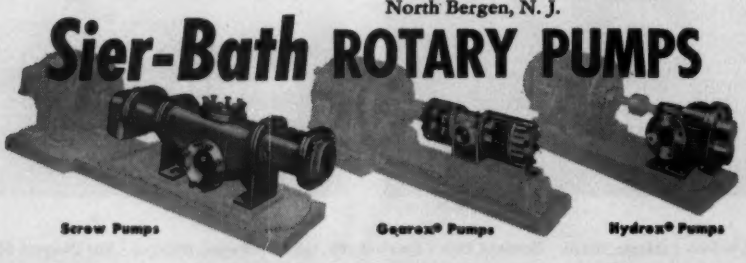
Internal Gear and Bearing Type for lubricating liquids and semi-liquids

Sier-Bath Screw Pumps maintain high volumetric efficiency because "Dual-Controlled" precision rotor design prevents rotor-to-rotor or rotor-to-casing contact—provides a continuous flow without pulsation, hammering or vibration . . . without strains, misalignment and wear on rotors, shafts, bearings and gears.

Result: Dependable, uninterrupted pumping service—less maintenance—easier servicing—longer pump life—lower overall pumping costs.

Capacities from 1 to 2,000 gpm.; viscosities from 32 SSU to 1,000,000 SSU.; discharge to 1,000 psi. for viscous liquids, 200 psi. for water and light oils. Horizontal or vertical construction. Corrosion resistant alloys, special bodies, stuffing boxes and bearings for special needs. See "Yellow Pages" for your Sier-Bath representative or write Sier-Bath Gear & Pump Co., Inc., 9237 Hudson Blvd., North Bergen, N. J.

Sier-Bath ROTARY PUMPS



Screw Pumps | Gerotor® Pumps | Hydrox® Pumps

Founded 1905 | Mfrs. of Precision Gears, Rotary Pumps, Flexible Gear Couplings | Member A. G. M. A.

sentment, if any, in our country to Canadian consulting firms who carry out assignments for United States clients, among them several who derive much of their income from jobs done in the United States.

Charles A. Lawler
H. E. Bovay, Jr.
Consulting Engineers
Houston, Texas

Questions Computer Economics

Sir:

I read with interest the article on computers for small consulting firms by Edward G. Brender and Thomas A. Weyand. Our firm has been very interested in computers for use in design work for over two years now.

We had checked the cost of the LPG-30 which is in the vicinity of $55,000. If this cost was amortized over five years, I believe the charge would be $11,000 per year and not $730 as listed in the article. Also, there is no charge for the operation of the computer by one of the staff personnel. I would appreciate an explanation as to why Mr. Brender has used only $730 for a total cost of operation annually of $1111. I would think the average annual operating cost would be nearer $12,000 – all things considered.

Edgar P. Snow
C. W. Riva Co.
Providence, Rhode Island

*READER SNOW IS CORRECT. THE TABLE OF "ANNUAL" COST ESTIMATES ARE IN FACT MONTHLY COSTS.

Name Misspelled

Sir:

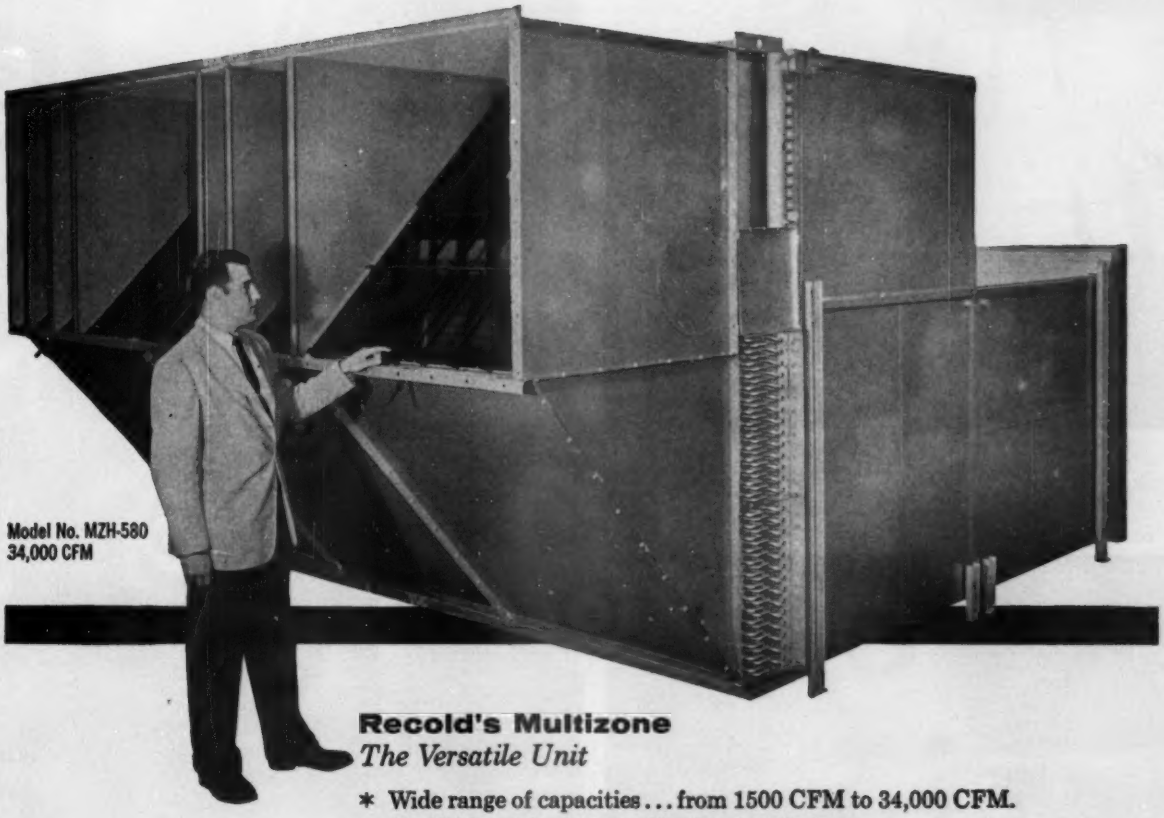
Please refer to your article on Shopping Centers, page 101 of the July edition of CONSULTING ENGINEER.

As a subscriber to your publication and a consulting engineer to one of the projects described, I was most disappointed to see the misprint of our name, which is Greenhorne & O'Mara and not Greenhaut & O'Mara.

Marcus F. H. Greenhorne
Greenhorne & O'Mara
Hyattsville, Maryland

For the Finest in Air Conditioning,
See the man who
represents

RECOLD



Model No. MZH-580
34,000 CFM

Recold's Multizone
The Versatile Unit

* Wide range of capacities... from 1500 CFM to 34,000 CFM.
* Available with vertical or horizontal discharge.
* Available with vertical or horizontal air intake.
* Large plenum chamber with air diffusers for best air distribution over cooling coil.
* Angle iron frame for rugged duty.
* Large slow speed blowers for quietness.
* Available with backward curved wheels.

For application in varied installations including:

Medical Suites	Hotels
Office Buildings	Churches
Night Clubs	Factories
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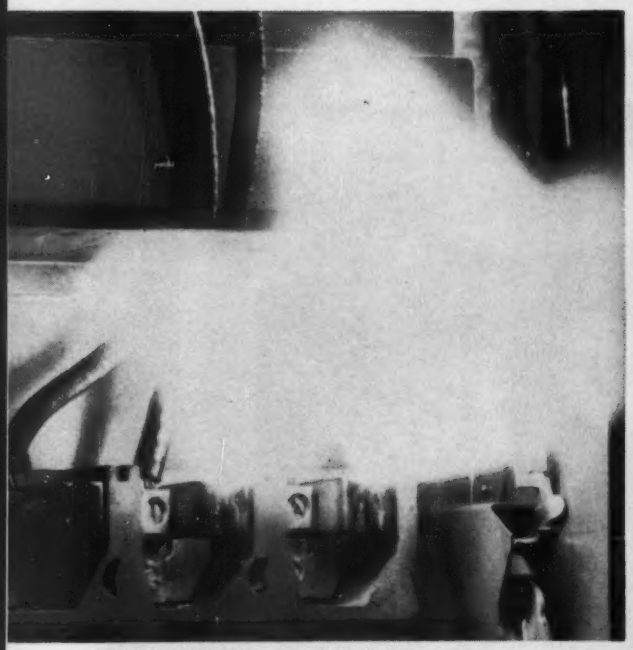
Private Club Rooms	Schools

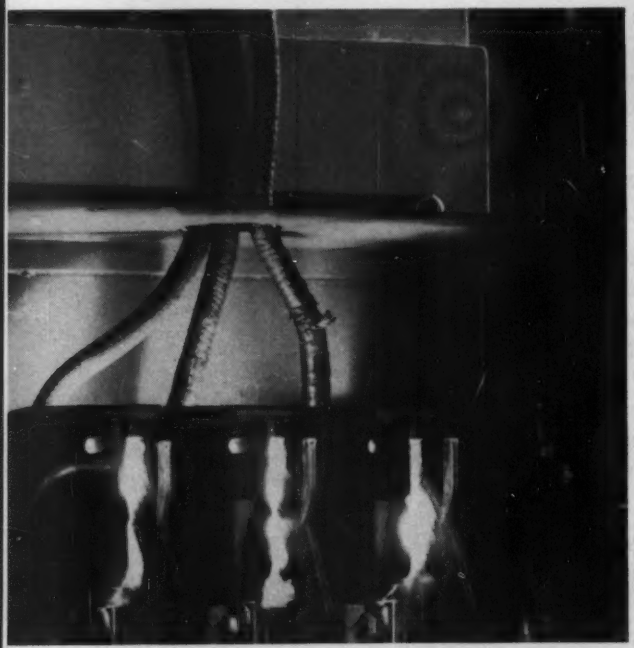
RECOLD 7250 East Slauson Avenue, Los Angeles 22, California

Complete line of Air Conditioning Coils, Evaporative Condensers and Air Handling Units

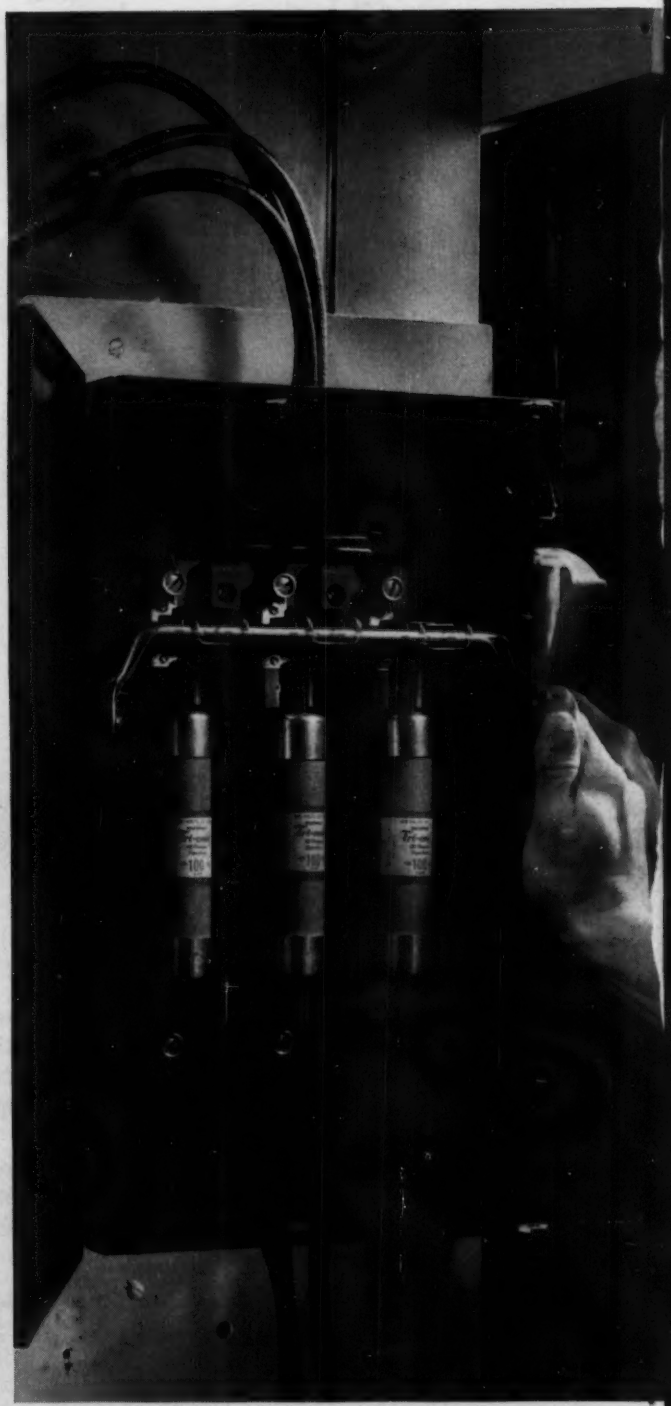
FOR SAFETY'S SAKE:



1. RUINOUS ARC in open knifeblade switch. At moment of "break" a flash explosion occurs. Blades pit, burn, deteriorate. Danger of fire is ever-present in open blade switches.



2. SUBDUED ARC in modified knifeblade switch. Closures or "quenchers" retard arcing slightly, but since blades must ultimately be pulled clear of closures the hazards still exist.



3. MAXIMUM SAFETY found only in BullDog Vacu-Break® Safety Switches. Arcing is confined inside compact Vacu-Break chambers. Arcs are snuffed out before they can cause any serious damage.

Unretouched photographs of the arc in 100-amp 600-volt switches operating under 90-amp 440-volt load with 40% to 50% power factor. All pictures taken at exact instant of "break".

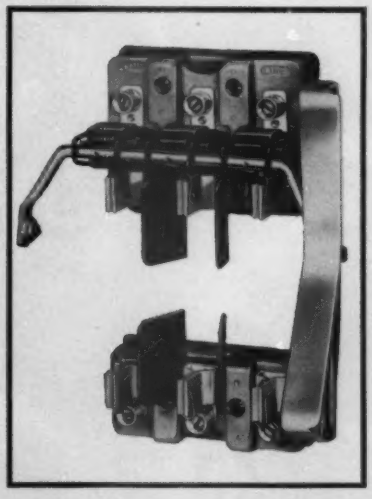
Let's take a good, long look at safety in today's safety switches

THERE'S A BIG DIFFERENCE in safety switches—a difference between maximum safety and half-way safety . . . low maintenance and excessive maintenance. These differences are quickly apparent when you compare BullDog Vacu-Break* Safety Switches with the other main type—the open knifeblade switch.

BULLDOG discarded the knifeblade design twenty years ago when they engineered the Vacu-Break. It is based on the engineering principle that an arc is the least destructive or dangerous if confined in an arc chamber which limits the oxygen supply . . . actually starves the arc before it can build up. "Explosions" are non-existent . . . the need for maintenance of contact points is virtually eliminated. Today, only BullDog has the Vacu-Break or anything like it. And it is available at no extra cost on both the Master and Junior types.

OPERATION of the Vacu-Break is simple, sure and safe. A sturdy rod attached to the operating handle is clamped directly to the Vacu-Break heads. When the handle is pushed "Off", this rod literally yanks the heads away from the stationary contacts. *Double "break" action is quick, foolproof.* Unlike knifeblade types, you need not depend on tricky spring and trigger mechanisms. You don't have to open the switch cover and check to see that contact has been broken!

100,000 AMP TEST. BullDog Vacu-Break Safety Switches, when used with current-limiting type Amp-traps**, will withstand the most severe fault currents. In recent tests standard BullDog switches with Amp-traps have been subjected to a 100,000 amp short circuit current. *The switches were undamaged!*

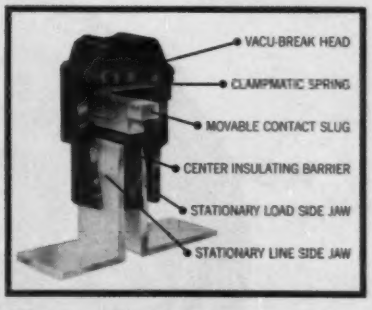


Vacu-Break heads are connected directly to the switch handle. No toggles or triggers, no tricky springs . . . no danger of switching failure. One of several exclusive BullDog Vacu-Break features that set the performance standards for the industry.

THE CLAMPMATIC ASSEMBLY (see the illustration below) is another safety feature of BullDog Vacu-Break Safety Switches. It gives bolt-tight contact in the "On" position, helps accelerate "break" when the switch is pushed "Off".

VALUE. You pay no more for Vacu-Break Safety Switches . . . yet you get the maximum in safety and full-time performance. *Compare*—and you'll buy BullDog. See your electrical distributor, contractor, or call a BullDog field engineer.

© BEPCO



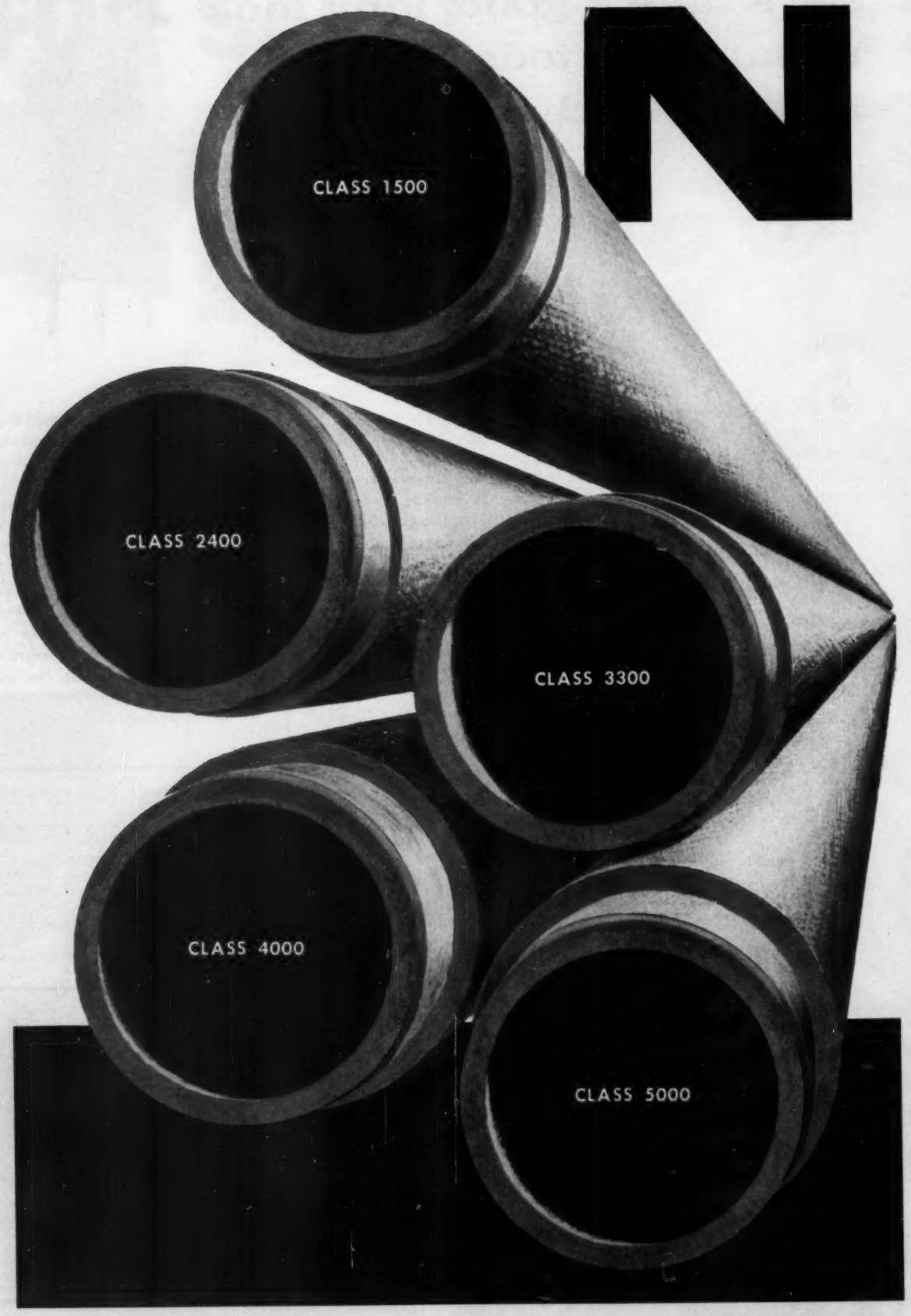
Close-up of Vacu-Break head shows movable contact slug inside the compact, oxygen-limiting chamber. Clampmatic assembly assures bolt-tight contact, speeds "break". This combination guarantees positive, safe operation, long switch life.

BULLDOG

BullDog Electric Products Company, Division of I-T-E Circuit Breaker Company, Detroit 32, Mich. *BullDog Export Division:* 13 East 40th St., New York 16, N.Y. *In Canada:* BullDog Electric Products Co. (Canada) Ltd., 80 Clayson Rd., Toronto 15, Ont.

* *Vacu-Break and Clampmatic are registered trademarks of the BullDog Electric Products Company.*

** *Amp-Trap is a registered trademark of the Chase-Shawmut Company.*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5 ENGINEERING CLASSIFICATIONS OF "K&M" ASBESTOS-CEMENT SEWER PIPE!

Now select "K&M" Sewer Pipe that exactly meets the requirements of soil conditions.

These five new crushing strengths in a variety of sizes by "K&M" bring sewer pipe specifications closer than ever to pinpoint accuracy.

Because never before have you been able to so exactly match the requirements of different laying conditions. Now you can minimize over-buying and costly concrete encasement. Now you can plan pipe layouts the way you've always wanted!

You can select "K&M" Asbestos-Cement Sewer Pipe to suit the depth of cut, the width of trench, the weight of the soil, and the manner of bedding. You can use more realistic safety factors . . . attain greater overall economy. In short, you can select "K&M" Asbestos-Cement Sewer Pipe specifically designed to fit your job.

Write today for more information on this remarkable new development in sewer pipe. You'll eliminate planning headaches . . . and save money for your community.

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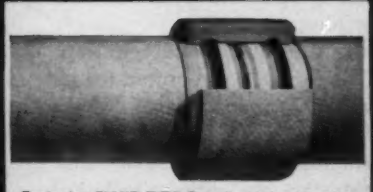
"K&M" ASBESTOS-CEMENT SEWER PIPE now classed by Standardized Crushing Strengths
(Minimum strength in lbs. per lineal foot —ASTM 3 Edge Bearing Method)

Size Inches	Class 1500	Class 2400	Class 3300	Class 4000	Class 5000
6	1500	2400	3300		
8	1500	2400	3300		
10	1500	2400	3300	4000	5000
12	1500	2400	3300	4000	5000



Exclusive FLUID-TITE Coupling joins lengths of various crushing strengths and sizes. Assemble it in any weather—without the aid of heavy machinery. It's water-tight and root-tight.

From the Editor's

Tranquil Tower

THE EUROPEAN PRODUCTIVITY AGENCY of the Organization for European Economic Cooperation (OEEC) has just published a booklet entitled, "Some Aspects of Consultant Engineering in the United States." It can be purchased by writing to their publications offices at 1346 Connecticut Ave., N.W., Washington 6, D.C. The price is $1.25.

This report is based on information and impressions picked up by a "Mission" that visited the United States in 1956 for six weeks. The members of this mission visited New York, Buffalo, Detroit, Chicago, Minneapolis, and Knoxville. Included were contractors, consulting engineers, and engineering employees of government and industry from Belgium, France, Germany, Ireland, Italy, Turkey, and the United Kingdom.

U. S. consulting engineers will find this report fascinating reading. It is interesting to see the impression the foreigner gets in a six-week visit to this country. It is particularly disquieting to note the generally incorrect conclusions of the report, resulting from the improper weighing and inept combining of generally factual data.

The OEEC report on the U. S. consultant is about as accurate as a chemical analysis stating that air is a gas containing neon, methane, krypton, and xenon. It mentions minor ingredients and ignores all the important ones.

It would take too long to go into the many errors of fact, much less those resulting from inference and poor proportioning. A few examples should give the idea.

On the subject of state registration, the report says, "The formalities required for state registration are completely independent of the technical education or qualification of the engineer. . ." Yet, a few paragraphs later we have, "The qualifications for registration are entirely technical . . ."

In the next paragraph: ". . . there was the impression that in some states the standard required for registration as a 'Professional Engineer' would be below that required for membership of an association of consulting engineers. For instance, a booklet was used in one state outlining the special courses of instruction to engineers preparing to take their state registration examinations. It dealt with engineering problems of a very simple nature, the inference being that a relatively limited standard of engineering knowledge would satisfy the examiners in that state."

There is no explanation of the kind of "association of consulting engineers" the report is referring to. We know of no association, technical, professional, or otherwise, in this country that gives an examination in connection with application for membership. It is also obvious that in speaking of the examinations, the report's comments relate to "Part 1" given to students upon graduation from engineering school. Naturally this infers a "relatively limited standard of engineering knowledge."

The report concludes with this statement:

"The fact that the European consulting engineer is accustomed to dealing with various manufacturers and techniques enables him to seek in every country — including the United States — the best answers to his client's needs. By contrast, the American consultant usually is limited to the methods practiced in his own country."

This conclusion is nothing less than a statement that European engineers are the best anywhere in the world. American engineers are worthless outside the U.S.

We understand that the OEEC is financed entirely by subscriptions from the 17 European member governments, so we have very little to say about what they publish or the incorrect impressions given, but OEEC does work closely with our International Cooperation Administration, and it is quite likely that ICA had an opportunity to criticize this text before publication. If they had the opportunity, then they certainly should have had the manuscript read by some competent authority on the private practice of engineering in this country.

In fairness to the report, it should be pointed out that nowhere does it seem to intentionally deviate from the truth. But it does mix fact with misunderstanding so thoroughly that the result is an inseparable compound, colorless and tasteless, but with a definitely irritating odor. ▲▲

Gary

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one piece resistance welded construction.

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for greater load-carrying capacity.

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for reduced maintenance costs.

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for most economical installation.

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Gary welded grating installations cost less because you eliminate expensive alterations and piecing together on the job. Gary installations look better too. All members line up perfectly for that "tailor made" look. Cutouts and other details that take so much longer to do in the field are completely finished at the factory. Gary welded grating, designed for specific loads and deflections, is as easy to specify as it is to install.

Get all the facts about the advantages of Gary Welded Grating. Write for Bulletin CE-98.

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GRATING DIVISION
4015 East Seventh Ave. • Gary, Indiana

From pit to plant, LeTourneau—

New 400 HP LW-80—world's largest coal hauler—is 12' high by 12' wide, 54½' long. It hauls 100 cubic yards (80 tons) per trip at speeds up to 34 mph.

Westinghouse moves with coal

Earthmoving equipment manufacturer estimates steam generated from coal costs only half as much as competitive fuels

At LeTourneau-Westinghouse Co., Peoria, Ill., steam is used to heat an area that has swelled to a million square feet of space. Increasing demand created the need for a modern heating plant to replace obsolete equipment. When plans were drawn for the new plant, fuel surveys indicated that the firm should continue to use coal for availability and economy. Estimates showed that steam produced from burning coal in this area costs about *half as much* as from competitive fuels.

Today LeTourneau-Westinghouse has found that burning coal in modern equipment cuts costs in several ways. Fuel costs, of course, are at a minimum. Automatic, efficient operation has lowered coal and ash handling costs. And manpower requirements have been reduced from 12 to 7 men.

Facts you should know about coal

You'll find that bituminous coal is not only the lowest-cost fuel in most industrial areas, as in the case of LeTourneau-Westinghouse, but up-to-date coal burning equipment can give you 15% to 50% more steam per dollar. Today's automatic equipment can pare labor costs and eliminate smoke problems. And vast coal reserves plus mechanized production methods mean a constantly plentiful supply of coal at stable prices.

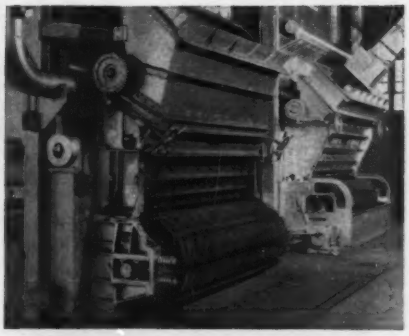
Technical advisory service

All companies planning a new power plant, or the remodeling of a present one, should consult an engineering firm on its design and construction. As a matter of fact, every Bituminous Coal Institute advertisement advises its readers to take this step. When you have such a project, our Engineering Staff will be glad to assist you in your fuel cost survey with any coal information you may require.

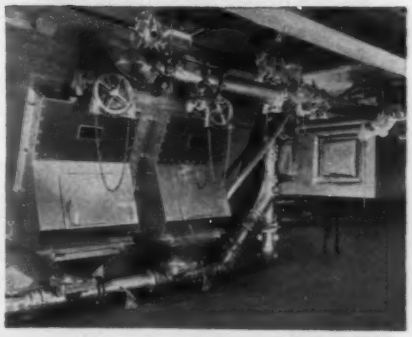
Meanwhile, we believe you will be interested in our informative case history booklet, complete with data sheets. Write to the address below for your copy.

BITUMINOUS COAL INSTITUTE

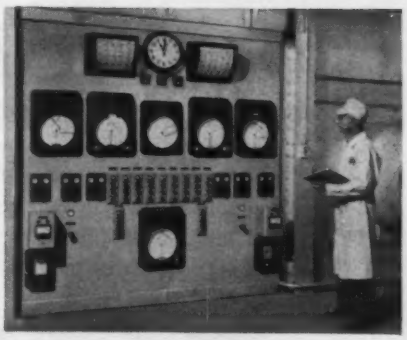
Department CE-09
Southern Building, Washington 5, D. C.



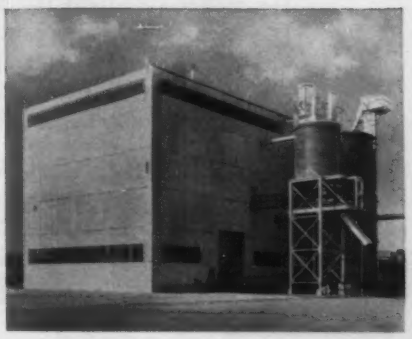
View in the LeTourneau-Westinghouse heating plant. In foreground is an Erie City 40,000 lb/hr type I.W.T. boiler which is used on stand-by basis and for peak loads in extremely cold weather. At the right rear is Erie City 60,000 lb/hr main boiler. Both are fired by Combustion Engineering Inc. traveling grate stokers.



Shown are ash hoppers, part of United Conveyor ash handling system. Ashes are dumped from ash pits into hoppers from where they are piped pneumatically to silo. This system also handles dust from Prat-Daniel dust collectors.



Bailey Control Panel regulates both boilers, including boiler meters and recorders, feedwater controllers and alarms, drum level recorders and alarms, multipointer gages for draft control and return condensate recorders.



New heating plant showing 9000 cu ft Kalamazoo Tank & Silo Co. coal silo (on right). Coal feeds from railroad car into track hopper, then moves by screw conveyor to 40 ton/hr bucket conveyor which elevates coal to top of silo. Entire coal handling system by Beaumont-Birch Co. To left of coal silo is Kalamazoo 25-ton ash silo equipped with United Conveyor dustless rotary unloader.

PRODUCT CARAVAN on NATION-WIDE TOUR!

Throughout this year and next, Square D's *Product Caravan* will be on tour, presenting and demonstrating its broad line of electrical control and distribution equipment to industrial plants, architects, electrical contractors, distributors and consulting engineers all over the country.

Each of the two 33-foot-long *Product Liners* is a mobile showroom featuring a wide variety of action exhibits. Square D Field Engineers are serving as hosts, demonstrating equipment and discussing electrical problems and applications. The smaller vehicle (*extreme right, above*) is a "hospitality wagon" from which refreshments are served.

Main objective of the *Product Caravan* is to present key audiences with interesting, tangible proof of Square D's continuing design leadership in the field of electrical distribution and control.

FIELD ENGINEERING SERVICE is available through more than one hundred Square D offices, backed by an international network of over 1000 authorized electrical distributors and 17 plants in the United States, Canada, Mexico and Great Britain.

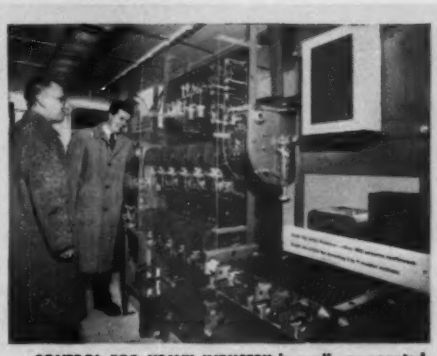
Executive Offices • 6060 Rivard Street, Detroit 11, Michigan

EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY

electricity is distributed and controlled

Finest CIRCUIT BREAKER ever built is Square D's claim for its QO breaker. With the above demonstrator, visitors test its performance under five different load conditions.



CONTROL FOR HEAVY INDUSTRY is well represented. Visitors can take over as crane operators. Above, BC&M CRANE CONTROL and TAB-WELD RESISTORS.

Cutaway models of CONTROL CENTERS, DIMMERBOARDS, SWITCHBOARDS, and PANELBOARDS afford complete inspection of design and operation.

Movable wings open on the sides of the Coaches, exposing exhibits and providing spectator ramps. Special electro-hydraulic system raises brilliantly lighted canopies 8 feet above coachtop level for nighttime displays.

A *Complete* LINE OF ELECTRICAL DISTRIBUTION AND CONTROL EQUIPMENT

ADJUSTABLE SPEED DRIVES
BUSWAYS & WIREWAYS
CIRCUIT BREAKERS
CONTROL CENTERS
CRANE & HOIST CONTROL
DISTRIBUTION SWITCHBOARDS
ELECTRIC TRUCK CONTROL
HIGH VOLTAGE CONTROL
LAUNDRY CONTROL
LIFTING MAGNETS
LIGHTING AND POWER PANELBOARDS
LIGHTING CONTROL—LOW VOLTAGE
LIMIT AND FOOT SWITCHES
MACHINE TOOL CONTROL
MAGNETIC BRAKES
METER MOUNTINGS
MOTOR STARTERS
PRESS CONTROL
PRESSURE, FLOAT, & VACUUM SWITCHES
PUSHBUTTONS
RELAYS AND CONTACTORS
RESISTORS
SAFETY SWITCHES
SERVICE ENTRANCE EQUIPMENT
STAGE DIMMERBOARDS
STEEL MILL CONTROL
SWITCHGEAR & UNIT SUBSTATIONS
SYNCHRONOUS MOTOR CONTROL
TERMINAL BLOCKS
TEXTILE MACHINE CONTROL
TIMERS
VOLTAGE TESTERS
WELDER CONTROL

The Word From Washington

EDGAR A. POE
Consulting Engineer Correspondent

WASHINGTON is optimistic. Economists who were predicting 6 million jobless for this coming winter and 5 million by next spring now say the picture has changed. Indications are that the gross national product (goods and services) will continue to rise the remainder of this year and well into next year. Government officials currently estimate GNP will hit $440 billion and possibly $443 billion in 1959.

Total construction will jump $2.5 billion in the first half of 1959, compared to the corresponding 1958 period. New construction in June 1958 was at the annual rate of $47.5 billion. Highway building should hit a record high, and military construction will have the biggest dollar volume since World War II.

New Planes but Old Airports

Airports across the country are engaging architects and engineers to help them meet requirements for commercial jet aircraft. These $6-million planes will carry 150 passengers at twice the speed of today's big airliners.

Airports will have to cope with terminal noise, and make provision for new passenger loading arrangements, bigger servicing areas, fuel and demineralized water storage, and longer runways. The fact that gasoline storage equipment cannot be adapted economically to handle jet engine fuel also is a problem. But engineers and architects believe present airports, while not entirely satisfactory, can be transformed to meet the jet age.

Air Transport Association, trade association of the nation's scheduled airlines, says people generally do not realize that the jet commercial passenger plane is so close at hand. By 1961 jets should be the basic commercial aircraft in this country.

Government Training

Many Federal engineers and scientists may receive special training at government expense. A new law provides that an engineer or other technical employee so trained must serve the government at least three times the length of the training period. The trainee receives his regular salary plus travel, tuition, and books. The law prohibits outside training solely for acquisition of an academic degree.

Highway Progress

The interstate highway program continues on schedule, according to commerce secretary Sinclair Weeks. Contracts for 469 miles of interstate and defense highways were awarded in June for an estimated $195 million, about twice May's $105 million.

The Bureau of Public Roads said preliminary engineering worth $14 million and right-of-way acquisition estimated at $34 million were authorized in June. By July 1 construction was under way on 3167 miles of the interstate system. Since the program started (July 1956) 1771 miles have been completed costing $439 million.

Ruling Requested

The U.S. Supreme Court will rule on a petition that in effect challenges the jurisdiction of the Corps of Engineers. The litigation grows out of a proposed government dam at McGee Bend, Texas. Attacking the proposal is the Neches River Conservation District. Water rights are the point at issue. Some 60,000 acres of timberland would be destroyed by backed-up water from the dam.

Deferred Income Taxes

A bill to permit consulting engineers and other self-employed persons to set aside retirement funds without paying income taxes on them until used will not reach the President's desk this session.

Despite administration opposition (it would cost the government $365 million in lost revenue) the House has approved this Jenkins-Keogh bill enabling most self-employed to reduce immediate taxable income by 10 percent or more. Taxes could be deferred on funds earmarked for retirement trust funds or endowment annuity policies until the taxpayer reached 70. ▲▲

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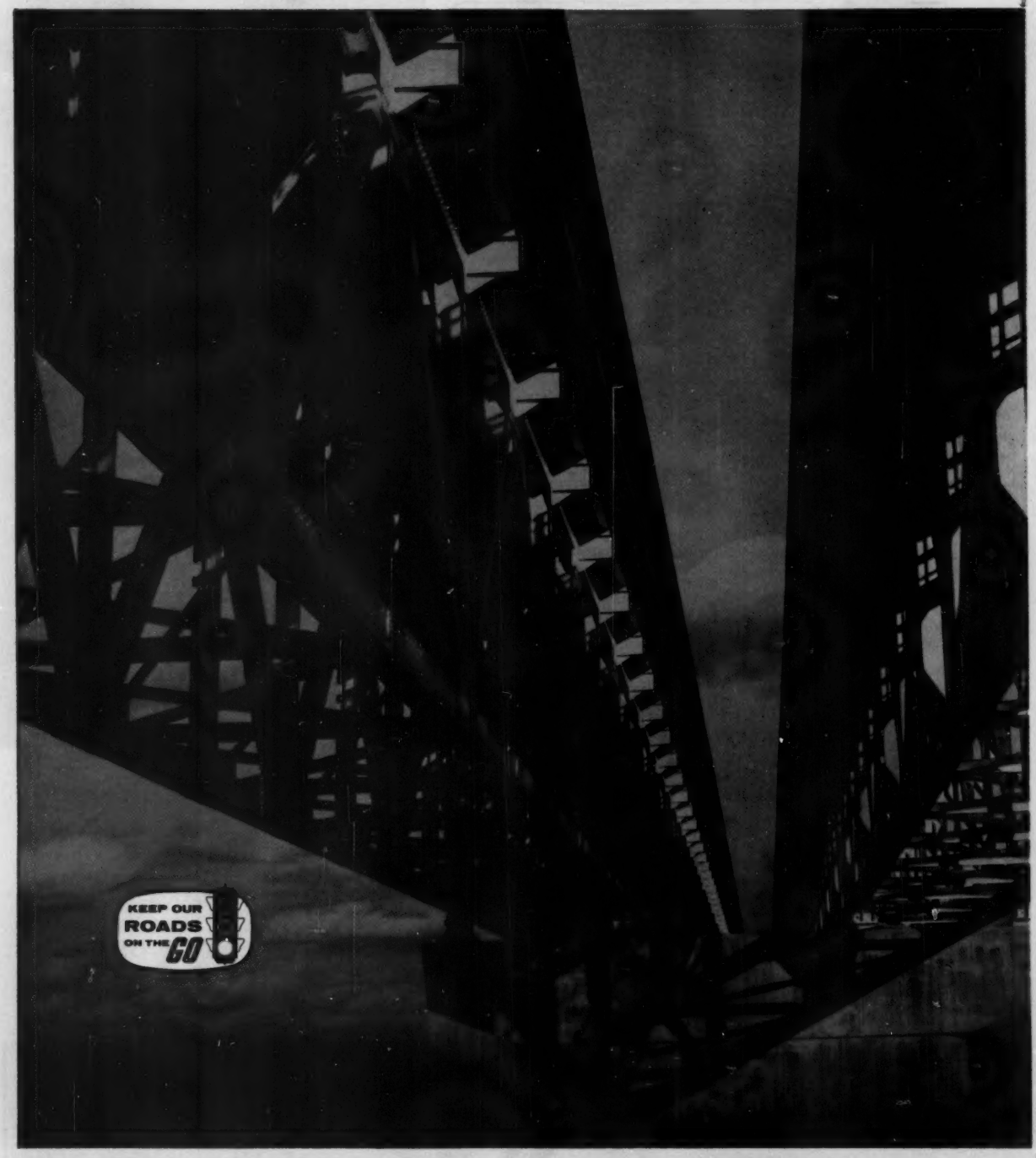
Bridge builders save



These twin, continuous deck roadways span 2306' across the Kaw River, on 4310 tons of USS TRI-TEN Steel and structural carbon steel.

$100,000 with USS Tri-Ten Steel

in the Kansas Turnpike's biggest bridge

THIS BRIDGE would have weighed 4,810 tons if it had been built entirely from structural carbon steel. Instead, the designers used USS TRI-TEN Steel for the more heavily stressed chords and diagonals. Because of the stronger steel, these parts could be made thinner, and lighter—*500 tons lighter*, with an estimated saving of *$100,000* in total steel costs.

TRI-TEN Steel members can be made lighter with no loss of strength because TRI-TEN Steel has a much higher yield point than carbon steel—50% higher in thicknesses of ¾" and less—and it meets fully all of the requirements of ASTM Specification A242 for High-Strength Low-Alloy Steels. Because lighter members can be used, dead weight can be reduced as much as 20%, freight costs are lower, and construction is easier.

For more information about construction for maximum strength and minimum weight with USS High Strength Steels—TRI-TEN, COR-TEN, and MAN-TEN—write for a copy of *"Design Manual for High Strength Steels,"* United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

USS, Cor-Ten, Man-Ten and Tri-Ten are registered trademarks

Fisher Memorial Bridge, Lawrence, Kansas
Owner—Kansas Turnpike Authority
Designer—Howard, Needles, Tammen & Bergendoff
Fabricator—Kansas City Structural Steel Co.
Erector—John F. Beasley Construction Co.

United States Steel Corporation – Pittsburgh
American Steel & Wire – Cleveland
Columbia-Geneva Steel – San Francisco
Tennessee Coal & Iron – Fairfield, Alabama
United States Steel Supply – Steel Service Centers
United States Steel Export Company

USS United States Steel

Forward Look in POWER

at Chrysler Stamping Plant with

28 lines of stamping presses are assured uninterrupted electric power by selective schemes

THE enormous load requirements of Chrysler Corporation's new 34-acre stamping plant at Twinsburg, Ohio: power for 260 presses ranging in speeds from ten to thirty strokes per minute; stamping forces up to 1600 tons; welding loads; lighting loads — all are met by the efficient use of primary and secondary substations and primary distribution equipment.

Chrysler engineers, after analyzing the specific requirements of the plant, designed a system which most adequately met the needs for supplying reliable power. Allis-Chalmers switchgear fills the requirements for dependable, uninterrupted service.

The result is a modern power distribution system combining flexibility, reliability and full power for all stamping, welding and lighting loads.

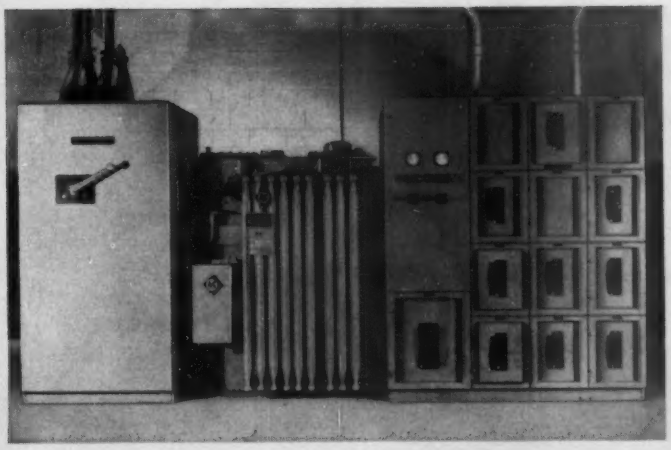
You'll find the answer to all your plant power needs in Allis-Chalmers equipment. Call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

All the auxiliary switchgear for a complete power plant—and all of it on a common aisle! This unusual installation includes, from left to right, 480-volt, 2400-volt substations and 13.8-kv switchgear.

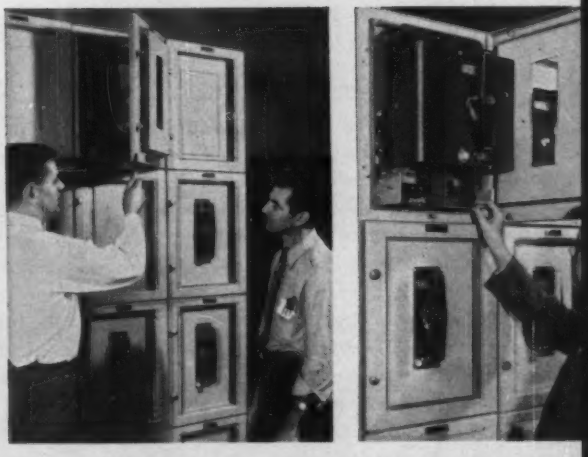
ALLIS-

There are 9000 kva of unit substation equipment in this one room! This equipment was located close to the load center by placing it in a room directly above the production area it serves.

Allis-Chalmers Switchgear



An Allis-Chalmers *First*, the reversible door panel provides breaker storage inside cubicle. Note that three panels are reversed or protruding to provide the additional space in the cubicle for storage of disconnected breaker.



Breaker compartment door swung open showing depth of reversible door panel, eliminating need for extra storage space. Calibrated scales on trip adjusting knobs provide accuracy of settings, action, adjustment and indication.

CHALMERS

A-5764

Heard Around Headquarters

MANUAL 29, the revised ASCE fee schedule, has been presented to the board of directors for final action at the annual convention in October.

Answers to some letters of inquiry, obtaining opinions of interested parties on the new highway fee schedule, still are to be received. The remainder, however, has received preliminary approval of the Conditions of Practice Committee.

Errors and Omissions Suits

Evidently word is getting around that a consulting engineer is an easy mark for a nice court settlement. More consultants have been sued or had claims filed against them during the past two months than in the preceding two years.

This is the warning of C. S. Carstens, who represents H. C. Hauth & Co. in group errors and omissions insurance dealings with CEC and the New York Association of Consulting Engineers. "Granted, we know about more cases because more consultants carry errors and omissions insurance than in the past," Carstens said. But even allowing for a 50 percent increase in the number of insured, claims and lawsuits have at least doubled.

The majority of these claims involve settlements, not litigation. As Carstens points out, "This is a serious situation, not just a pitch to sell insurance."

The New York City Board of Education contract with architects includes an indemnification clause wherein the architect agrees to hold the board not liable for any claims arising from negligent acts, errors, or omissions committed by the architect or his agents. This liability is shared with the consulting engineer.

Carstens said consultants everywhere should be cautioned against signing contracts carrying indemnification clauses without first checking with their errors and omissions carrier. With an additional premium, coverage can be obtained for such a project, but it is not included in the standard policy. An engineer should be sure that the client and insurance company understand whether he plans to supervise construction of a project or merely make routine inspections.

Carstens cited a $250,000 lawsuit against New York area mechanical and structural engineers and an architect for an employee of an air-conditioning contractor who fell from a scaffold. The man waived workmen's compensation, hoping for a larger settlement. He alleges faulty design and faulty supervision.

Some other cases:

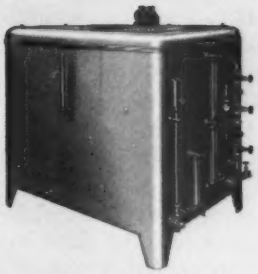
¶ A Midwestern engineer was ordered to replace a boiler in a professional building at his own expense. (He was insured.) The claim contended the furnace he specified was inadequate.

¶ In the New York area, an electrical contractor is suing a consultant. The contractor, whose bid was too low, claims the drawings for control wiring in an industrial plant were inadequate.

¶ Another Midwestern engineer is being sued, along with others, on a power plant project. During a

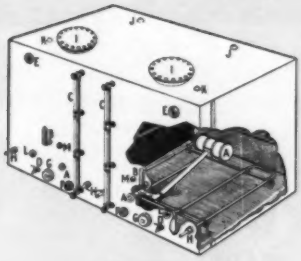
SPACE SAVING LUBRICATION SYSTEM

Figure 829 Self-Contained Lubricating Units offer a complete oil circulating and filtering system . . . compactly designed with filter, pumps, pressure tank, piping, alarms, gauges, etc.



OIL CONDITIONER

Figure 832-P — Filters and conditions turbine and other low viscosity, high demulsibility oils . . . without aeration, turbulence, heat or the use of moving parts.



RECEIVING AND STORAGE TANKS

Figure 363 — Two-Compartment Storage Tank permits precipitation of dirt and water from one batch while other batch circulates through system. Capacities 300 to 8,000 gallons.

Figure 360 — Receiving Tank receives dirty oil by gravity . . . precipitates dirt and water before pumping to filter. Capacities 100 to 6,000 gallons.

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"CUSTOM ENGINEER" your next lube system for big savings • unmatched performance . . . with this full line of advanced lubrication & filtration equipment! All sizes and capacities.

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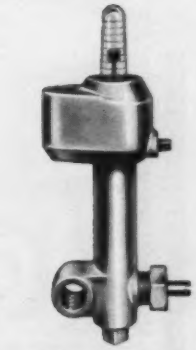
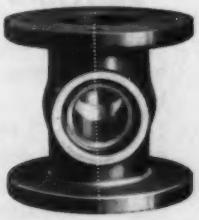
- ☐ Receiving & Storage Tanks
- ☐ Flow Sights
- ☐ Figure 823-P Oil Conditioners
- ☐ Figure 818 Oiler
- ☐ Teleflow Indicator

(Attach to your letterhead for quick response.)



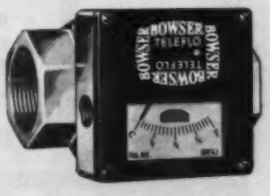
SIGHT FEED OILER

Figure 818 — Pressure-type oiler features location of indicator outside the liquid body making it ideal for use with dark liquids.



FLOW SIGHTS

Double window flow sights for vertical installation on gravity flow lines. Flow is clearly visible . . . glasses do not cloud.



TELEFLOW INDICATOR

Figure 815 offers easy reading graduated dial for close approximation of liquid in flow. Vane type indicators also available.

flood stage on a river, water backed up into the power plant through an intake pipe the engineer had designed. (There is a possibility that the power plant operators forgot to shut the intake-pipe valves.)

The cases vary. But the trend is consistent. Everyone is suing the consulting engineer.

Defense Fund

The Functional Section of NSPE has been authorized, by the board, to solicit funds from consulting engineers to give financial assistance in cases involving private practice.

First scheduled to receive such aid is the Lublin, McGaughy case this fall, in which the Supreme Court will rule whether the Wage-Hour Law applies to consulting engineer and architectural firms.

"It was felt that firms in such situations are faced with tremendous expenses defending a right or principle vital to all consulting engineers. Many consulting engineers have indicated a desire to share in this expense in recognition that their rights are equally affected by the outcome of the case," NSPE said.

Funds not used on the pending appeal will be utilized in defending future cases affecting the general welfare and interests of all consulting engineers.

Contributions can be mailed to the NSPE Consultants' Special Legal Fund, 2029 K Street NW, Washington 6, D.C.

More Government Engineering

A revenue bond authorizing TVA to perform engineering design services for nongovernment facilities is pending before the House Committee on Public Works. The bill already has passed the Senate.

In testimony before the House Committee, NSPE contended this revenue bond bill "constitutes an unwarranted interference with the normal functions and operations of private consulting engineers who have been and are available for such normal professional activities."

The NSPE statement said, "We believe, and we think the members of the committee agree, that the Federal government should not compete with its own citizens in the furnishing of material or services to nonfederal agencies or persons, except under the most extreme or emergency conditions."

It also was pointed out that professional engineering services are subject to state engineering registration laws, and TVA is not licensed under any state law to offer and perform professional engineering services for others.

Charles Pate, CEC president, also has notified Congressmen of opposition to the bond bill.

Union Survey

ASCE has just completed an extensive survey on employment conditions. The results — 57 percent return on 37,000 questionnaires to all ASCE members — showed a

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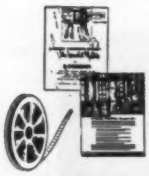

AIDS TO ARCHITECTS
- CATALOG 133—Spencer central vacuum cleaning systems.
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marked change in attitude toward unionization. Although questions were not identical, the survey was compared with a similar study made in 1953.

The recent survey shows that only 2 percent of those answering the questionnaire are union members. Five years ago, 3½ percent of those questioned were in unions.

Of the current union members (excluding a part-time trumpet-player who listed his union as the American Federation of Musicians), some 40 percent are in professional bargaining units, which are not authorized to strike.

Currently 76 percent do not consider collective bargaining advantageous for them. In 1953, only 63 percent were opposed to collective bargaining. (Note that the questions were worded differently.)

The latest study shows a continuing increase in state registration. Of the replies, 79 percent were checked as registered engineers or engineers in training, a 6-percent increase over the 1953 survey. Consulting engineers and their employees had the highest percentage of registration and engineers in training — 88 percent. Lowest was industry with 73 percent. Government employees were 77 percent registered.

Chamber Endorses Consultants

The U.S. Chamber of Commerce, which once published statements encouraging state and Federal highway departments to increase personnel to handle the accelerated highway program, has changed its mind about consultants.

A new statement makes it perfectly clear that the Chamber supports the private engineering profession in connection with building the nation's highway system.

The clause now reads: "Every effort should be made to secure modernization of state laws to provide for the advance acquisition of rights-of-way, controlled access, and the integration of road authority at all levels of government. The state, county, and municipal highway departments should work together in the planning and development of the highway systems. Steps should be taken to provide trained personnel and engineers, and *utilize to the extent possible private engineering firms.*"

Special Sanitary Certification

The American Sanitary Engineering Intersociety Board, first group in the nation for specialty engineering certification beyond state registration requirements, expects to list at least 1000 in its first manual to be published next year. Of the thousand, approximately 30 percent will be consulting engineers.

Formed in 1955, the ASEIB is sponsored by the American Public Health Association, American Society for Engineering Education, American Society of Civil Engi-

YMCA at Milwaukee, Wisconsin has a 35 KW Kohler stand-by plant.

Model 35R31, 35 KW, 120/208 volt AC. Remote starting.

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Complete manual, including suggested specifications, will be sent on request. Sizes from 500 watts to 100 KW, gasoline . . . 10 KW to 100 KW, diesel. Write Dept. A-13.

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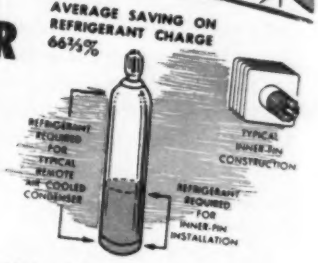
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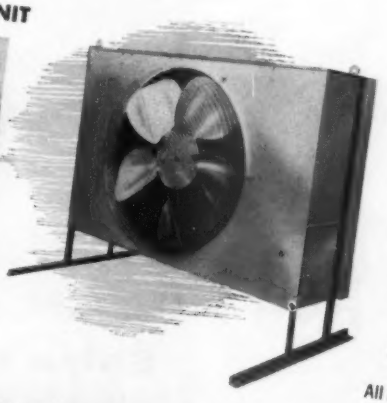
A RECENT 300 TON JOB SHOWED SAVINGS OF 1800 LBS. OF REFRIGERANT THROUGH USE OF THESE UNITS.

Yes, the Dunham-Bush 'BC' Remote Air Cooled Condensers with famous Inner-Fin construction mean savings of 67% in refrigerant charge. Additionally, they mean smaller receivers and minimum loss if the system charge is lost. In these expertly planned units, the exclusive Inner-Fin construction diminishes the internal volume of the coil while increasing the heat transfer coefficient. And higher heat transfer factors permit design of more compact units, saving valuable space in installation.

AS MUCH AS 53.5 TON CAPACITY IN ONE UNIT

The Dunham-Bush line of 'BC' Remote Air Cooled Condensers includes models in 13 sizes with capacities ranging from 2.2 tons to 53.5 tons, making possible use of a single unit for practically any job !



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'PS' units can be mounted indoors near the compressor, facilitating the making of necessary adjustments. They are thoroughly factory tested and assembled, and require connection only to the refrigerant liquid and discharge lines. No extra piping or special loops required. Regulating valve gives smooth pressure control and eliminates wide pressure fluctuations inherent in other head control systems.

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neers, American Water Works Association, Federation of Sewage and Industrial Wastes Associations, and American Institute of Chemical Engineers.

At present, five areas of specialization are recognized: water supply and waste water disposal, public health engineering, industrial hygiene, radiation hygiene and hazard control, and air pollution control. No one has been examined or furnished certificates in more than two fields.

In general, engineers who want to become certified must be of good moral character and high professional standing; possess a degree in engineering or its equivalent; be licensed to practice engineering; and have at least eight years of acceptable engineering experience in one or more phases of sanitary engineering after college graduation. In addition, at least four years of the experience must be in responsible charge of sanitary engineering work in design, management, research, administration, or teaching.

A "core" exam is taken by all applicants, along with an oral test and specialty examinations.

Support for the new organization has come generally from persons under 40, while most of the opposition is from engineers over 40.

Engineer Patent Rights

At the coming session of the Supreme Court, a second review is expected on whether the AEC has the right to disclose data on heavy water processing prior to the engineer-inventor's getting a patent.

The case previously had been remanded to a lower court from the Supreme Court. The defense contends that the lower court did not give an answer to the legal questions involved.

In a brief filed as friend of the court, EJC asks, "By what means can an inventor protect the secrecy of a discovery disclosed to the Government in confidence until he secures U.S. and foreign patent protection?"

World Student Engineer Congress

The first International Congress of Student Engineers was held at the Brussels Fair August 4 through 9. Of the 1000 last-term engineering students from 40 countries, many expressed a desire to round off their study with several years practical work and additional courses in the U.S. Then they plan to become consulting specialists in their home countries.

American delegates to the congress were Hannon Bryan, a graduate engineer of the University of Connecticut, and Hannah Weissenberg of New York.

In an inaugural address R. Goldstein, president of the International Federation of Student Engineers, said, "In general, European students are better prepared for their

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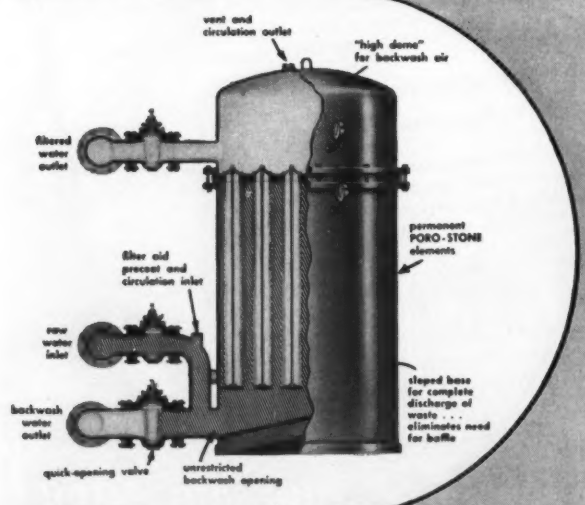
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Is your budget short of funds for needed filter area? Would you like to add to your present filter capacity for peak loads *without* constructing new filter housing?

The R. P. Adams IWF filter is an ideal answer to each of these problems.

First, you can add a maximum of filter area at a minimum cost with the IWF. Other filters *may* cost less initially, but up-keep, labor and replacement parts will rapidly offset any such advantage.

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Waste space in your sand filter housing probably will accomodate the IWF . . . eliminating the need for costly new construction.

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Adams IWF Filters come in six basic sizes from 53 to 238 square feet of area . . . in multiple unit plants from 106 to more than 1000 square feet of filter area. Normally delivery can be made from stock on hand.

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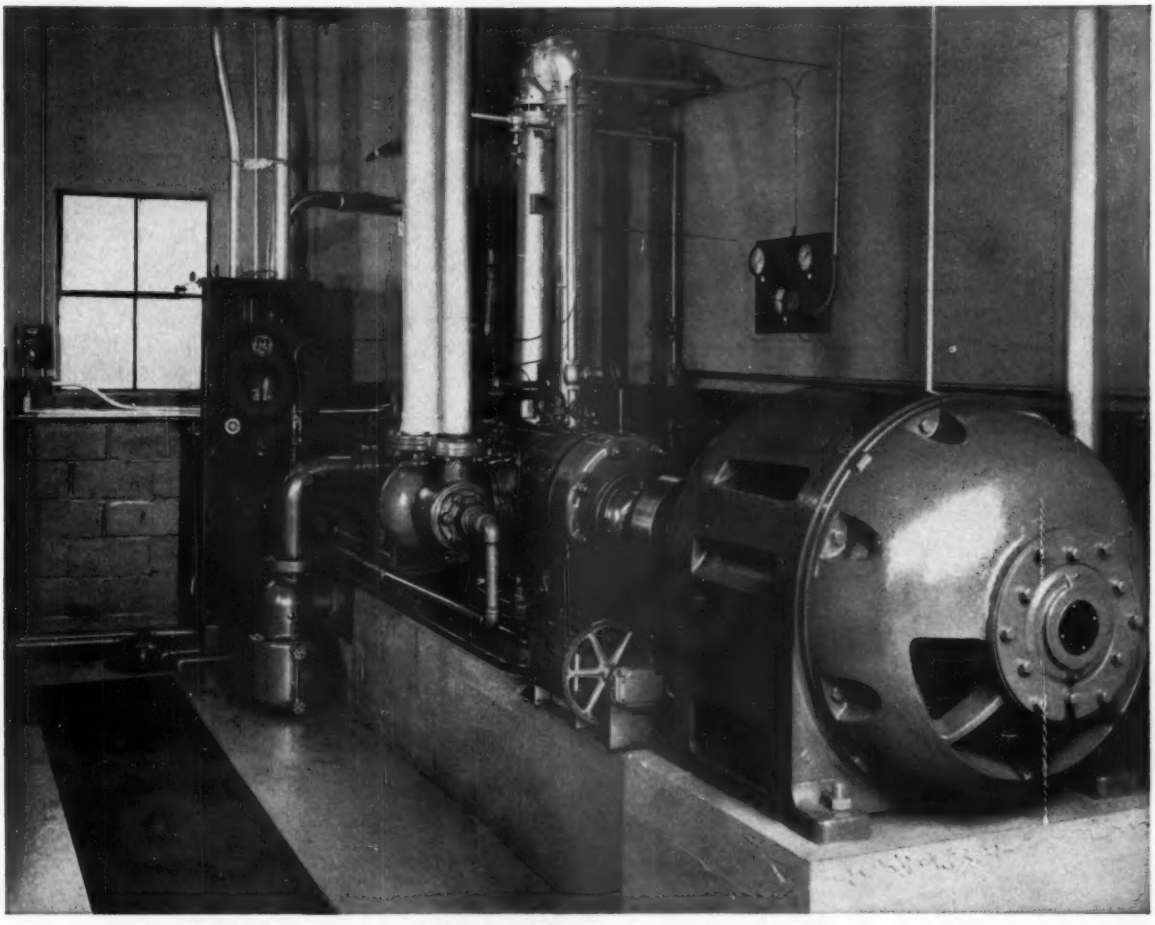

Fuller Rotary Two-Stage Compressor, C135-135H. Capacity 680 c.f.m., 100-lb. pressure, 690 r.p.m., 150 hp. motor.

16,000 HOURS OF OPERATION WITH NO MAINTENANCE

Empire Steel Castings, Inc., Reading, Pennsylvania, installed a C-135-135H Fuller Rotary Two-stage Compressor in April 1953. After 32 months—approximately 16,000 hours of operation—the compressor received a routine inspection, when a new set of blades was installed in the higher-pressure cylinder.

The Empire engineers report no downtime since replacement, although they've added 4,000 operating hours. Prior to switching to Fuller, their former experience with compressors was a different story—as many as several overhaulings in one year. With Fuller equipment furnishing a constant high capacity air supply, production costs have been greatly reduced.

Here's how Empire uses compressed air:

- In the molding department, supplying all air for pneumatic rammers, all squeeze and jolt machines, automatic set-out and lifting apparatus of mold conveyors, automatic shake-out machines, mold cleaning and spraying equipment.
- In the core department, for ramming equipment, spraying and torch drying equipment, core oven operation as well as core blowing equipment.
- In the cleaning department, pneumatic chipping hammers and grinders, blacksmith requirements, sand-blasting, pressure testing and miscellaneous tools.
- In the heat-treating department, heat treating furnace operation and cooling equipment.

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C-298
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work as consulting engineers because their training is more varied and more intellectual than that of their American counterpart." But felt the future European consulting engineers should complete their education in the U.S. "where unrivaled facilities for perfection of technical training are available."

Proposed ASRE-ASHAE Merger

December will be the time of decision for the proposed ASRE-ASHAE merger.

ASRE will announce results of a mail ballot during its 45th annual meeting, to be held in New Orleans. ASHAE will hold a simultaneous New Orleans meeting.

The merger, in the discussion stage among officials of both groups for two years, has met the usual pro and con arguments of any unifying movement. However, the decision is being made as soon as possible because, according to ASRE president Cecil Boling, "Both ASRE and ASHAE have long-range commitments to make on sites and facilities for meetings, headquarters locations, research facilities, possible staff changes, publishing problems, and many others."

Boling added that final plans might include a number of alternate methods for handling problems of local sections, allowing continued operations on a unified or a nonunified basis depending on the situation in particular areas.

AIChE Registration?

Professional development and professional legislation committees of the American Institute of Chemical Engineers are making a joint study to determine whether AIChE should back compulsory registration for chemical engineers.

Charles McCulloch, legislative committee chairman, explained that many states require the designing engineer to seal plans for public structures. However, seals are not required on chemical design work. Therefore, the chemical engineer has not been under the same pressure to become registered as those in other fields.

At present, AIChE has no policy statement on registration. ASCE and ASME have officially encouraged registration for some time now.

Agenda Released

The Sixth International Congress on Large Dams, to be held in New York City September 16 through 19, will feature discussion of four problems:

¶ Heightening of existing dams, including methods of constructing new dams in successive stages.

¶ Observation of stresses and deformations in dams and their foundations and abutments; and comparing these observations with computations and tests on small models.

¶ Compaction methods and moisture content for materials used in

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ELIMINATES THAT EXTRA SPLICE
The thru-connection saves you the time and bother of splicing and adding a wire nut. Wires normally spliced are inserted straight in under the thru-connection terminal post which holds them securely. This large head terminal screw will accommodate wire sizes from #14 to #10, and the two wires need not be the same size. For example, a #14 wire can be inserted under one side and a #10 under the other and still the terminal screw will hold both safely and securely.
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"Presswitch" operates in any position; requires no special wiring. It is an excellent control for large fluorescent lighting installations in offices, factories, institutions or homes.
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With some products, a company representative's natural enthusiasm is often *tempered* by actual test results in the laboratory.

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Comparative testing with standard Wrought Iron, as well as many ferrous substitutes, proves new 4-D Wrought Iron a decidedly superior deterrent to corrosion. So the wisdom of standard Wrought Iron specifications may now be further enhanced by specifying new 4-D Wrought Iron.

Byers field service engineers are lending even more credibility to this story with their own knowledge of corrosive infighting. The Byers representative will welcome an opportunity to relate these test results to your corrosive applications. Call him soon. Or, write us for helpful literature on new 4-D Wrought Iron. A. M. Byers Company, Clark Building, Pittsburgh 22, Pa.

BYERS WROUGHT IRON

constructing earth core and supporting fill for earth and rockfill dam construction.

¶ Use of admixtures and pozzolanic materials in concrete for dams and the influence of the finer sand particles in the concrete.

The discussion points were selected at an executive committee meeting in Lisbon two years ago.

After the formal meetings, representatives of the 38 member countries will have a choice of three study tours. A southeastern study tour will include visits to about 11 dams in the TVA region, and an inspection of the Corps of Engineers Waterways Experiment Station in Vicksburg, Mississippi.

A western study tour will visit eight dams from Boise, Idaho to Portland, Oregon.

A mid-continent tour will include visits to nine dams in the Missouri River Basin, terminating with a meeting at the Denver Federal Center of the Bureau of Reclamation where extensive hydraulic model studies are under way.

This meeting will mark the second time that the International Congress has been held in the U.S.

Engineer Building Fund Growing

A late financial box score on the United Engineering Center Building Fund shows goals and amounts collected:

¶ American Institute of Chemical Engineers: goal $300,000, collected $66,315 (22 percent).

¶ American Institute of Mining, Metallurgical, and Petroleum Engineers: goal $500,000, collected $67,373 (13 percent).

¶ American Society of Civil Engineers: goal $800,000, collected $68,336 (9 percent).

¶ American Society of Mechanical Engineers: goal $800,000, collected $52,355 (7 percent).

¶ American Institute of Electrical Engineers: goal $900,000, collected $35,197 (4 percent).

An additional $3,434,600 has been collected from industry. The United Engineering Trustees estimates additional assets available of $2 million including the expected proceeds from selling the present Engineering Societies building.

Besides the five founder societies, building occupants will include offices of the American Institute of Consulting Engineers, American Institute of Industrial Engineers, Inc., American Society of Heating and Air-Conditioning Engineers, Inc., American Society of Refrigerating Engineers, American Welding Society, Electrochemical Society, Inc., and Society of Motion Picture and Television Engineers.

The new building also will house the Engineers Joint Council, the Engineering Foundation, Engineering Index, Engineers' Council for Professional Development, and Welding Research Council. Tentative tenants are the National Coun-

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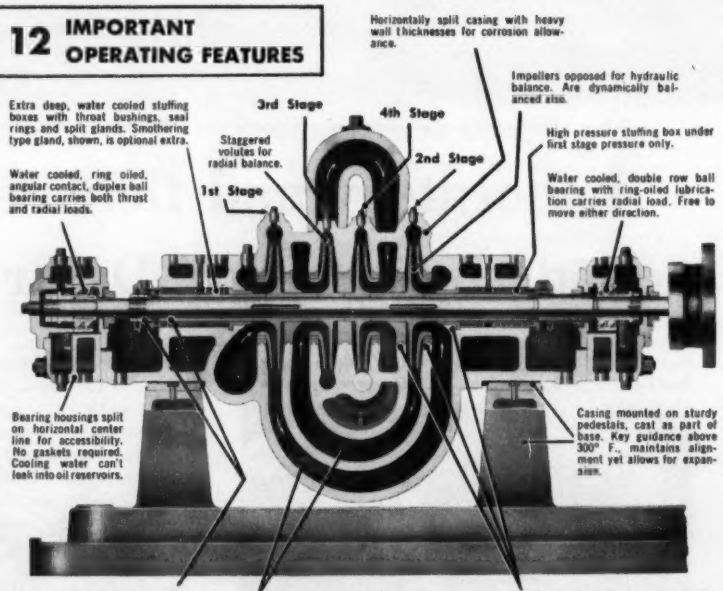
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Extra deep, water cooled stuffing boxes with throat bushings, seal rings and split glands. Smothering type gland, shown, is optional extra.
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Bearing housings split on horizontal center line for accessibility. No gaskets required. Cooling water can't leak into oil reservoirs.
Casing mounted on sturdy pedestals, cast as part of base. Key guidance above 300° F., maintains alignment yet allows for expansion.
Shaft sleeves with stuffing boxes prevent leakage along shaft.
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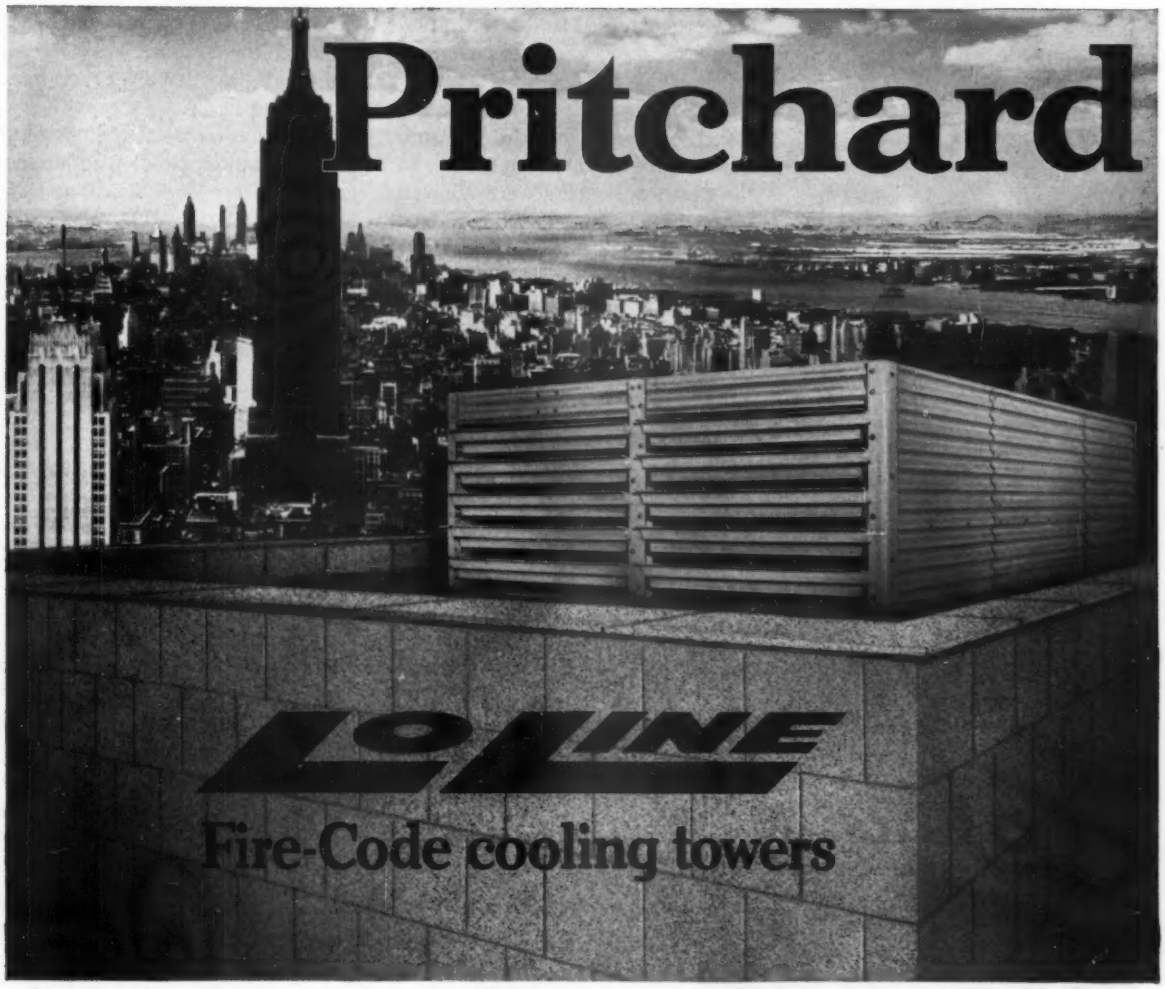

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A Pritchard LoLine Fire-Code cooling tower is not a tower at all. Webster defines a tower as "a building or structure typically higher than its diameter." But the LoLine is less than half as high as its longest dimension. Rather than protrude from your building or grounds like a monstrous growth, defying all attempts at camouflage, the Pritchard LoLine hugs its base, can be smoothly integrated with its surroundings.

Moreover, the Pritchard LoLine Fire-Code cooling tower is safe. A companion to the Pritchard LoLine wood-framed tower, it is designed specifically to meet standard metropolitan fire codes. All structural members are steel. Louvers, casing, water distribution system and fan deck are asbestos cement. There simply is no combustible material exposed to the risk of fire.

It's rugged, too. Corrosion-resistance of steel parts is assured by hot-dip galvanizing *after* fabrication, not before. Only heart-quality California Redwood is used for fill and drift eliminators. Long, trouble-free life is assured. And the tough, asbestos cement board exterior never needs painting. Maintenance is virtually eliminated.

If you would like more information about the 75-ton-and-up Pritchard LoLine Fire-Code cooling "tower," mail coupon for Bulletin 5.2.902. Or consult the Yellow Pages, under "Towers," for the name of your nearby representative.

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cil of State Boards of Engineering Examiners and the Society of Women Engineers.

The UET did not take over the remaining parcel of land for the new engineering headquarters on July 1st, as originally scheduled. Officials explained the remaining land is used by a Socony-Mobil service station. The lease has been extended to October so Socony-Mobil can find a suitable location for the service station.

Some time ago, a committee was appointed to investigate the possibility of pooled facilities (typing, mailing, and such) for the new building. No mention has been heard of this lately.

ASCE Insurance Expanded

The ASCE has expanded coverage for its group disability plan. This policy, which has been offered to members for 10 years, is underwritten by Continental Casualty Company. Recently, sickness benefits were increased from a maximum of two to three years for members under 60.

Among other benefit increases was the raising of principal sum benefits from $5000 to $7500. In the past, no benefits were allowed for mental illness. The policy currently allows coverage up to $1500 if the insured ASCE member is confined to a hospital.

Keen Observation

It all began with a statue in New York's Washington Square. The statue (of Alexander Lyman Holley, who brought the Bessemer process to the U.S.) is on an infirm foundation, according to some.

An ASME member noticed that the statue leaned a little, and thought the society might do something about it. So ASME checked.

It found that the city doesn't think the statue is leaning. Even if the statute were leaning, the city added, it would cost approximately $25,000 for a new pedestal. And besides, the statue is sitting in the middle of what may soon be a new street.

ASME has recommended that the EJC committee on honors undertake a "survey of the various statues, plaques, and other media recognizing the achievements of engineers and develop a plan for their permanent recognition."

Graduates Get Jobs

A report at a recent American Society for Engineering Education meeting showed that engineering graduates are much in demand.

Three weeks before graduation, 71 percent of the spring graduates had accepted jobs or had offers they seriously were considering. The study was based on a survey of 88 college placement officers.

Starting salaries for engineering graduates range from $475 to $500 a month. This is an increase of 3 to 5 percent over last year. ▲▲

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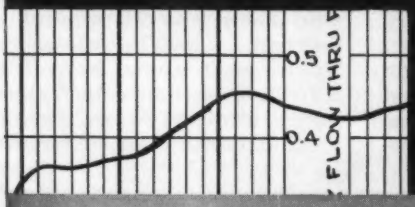

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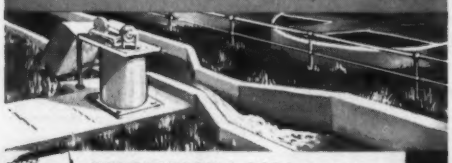

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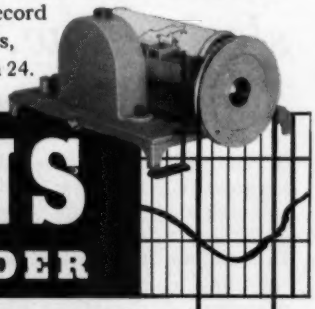

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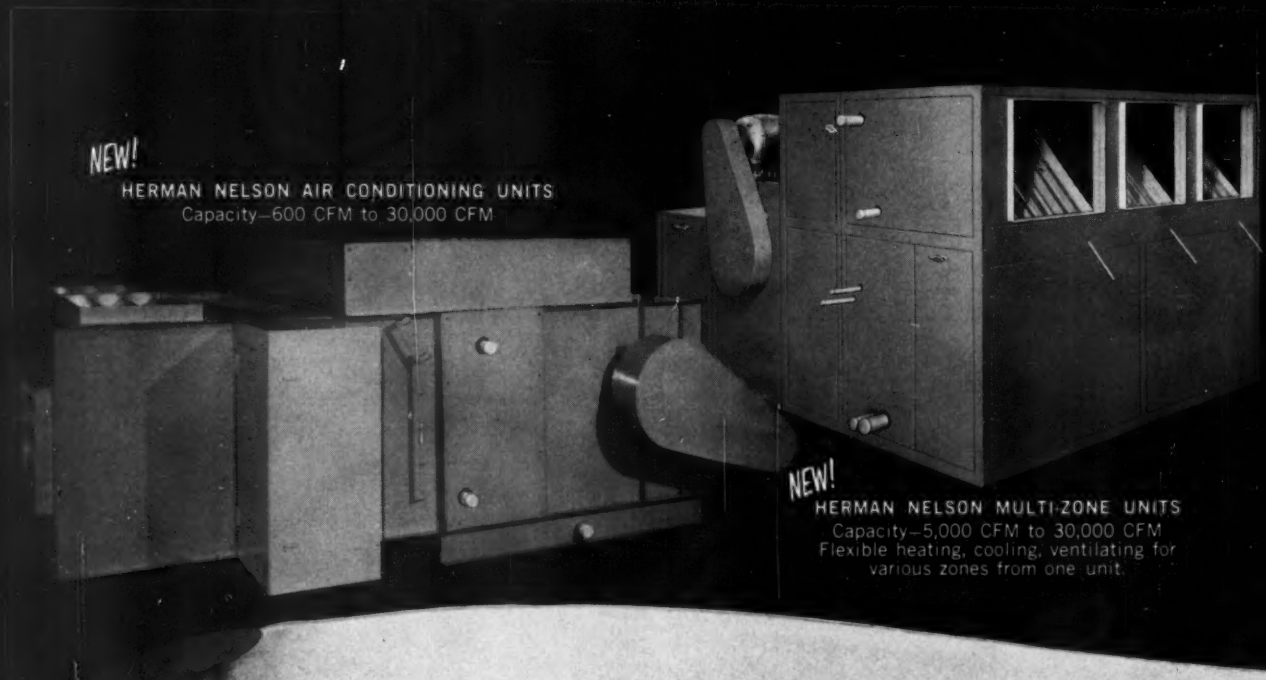
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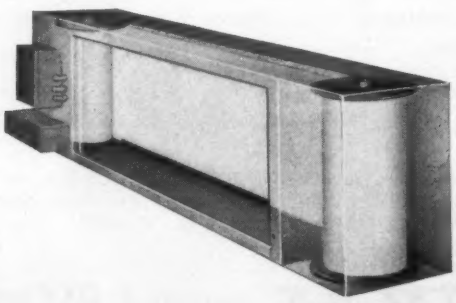

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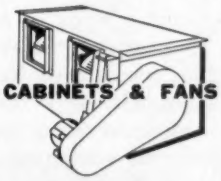

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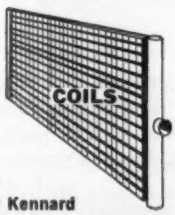

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Report from the West Coast

RALPH S. TORGERSON
West Coast Editorial Representative

A SURVEY BY THE CALIFORNIA Association of Consulting Engineers shows that the average member spends about 40 days a year on outside activities. Much of this time is part of an engineer's professional life, involving association activities, membership on government examining boards and committees pertaining to engineering, and educational work such as part-time teaching and lecturing or acting as a trustee to educational institutions.

Engineers may question whether so much outside activity is desirable when the time might be more profitably devoted to business. Significantly, however, some of the most successful consulting engineers give a large part of their time to outside activities. These men have found that in work of this type they have gained knowledge and prestige that more than compensates for the lost income.

One engineer in the Pacific Northwest teaching an evening class in prestressed concrete found the research he did was helpful in his professional work. Another engineer has been on a state engineering examining board for several years and is active in association work, yet his firm continues to be highly regarded in the profession and business is good.

Los Angeles CEAC Meeting

The importance of contacts with other engineers was brought out at the CEAC meeting in July in Los Angeles. A panel discussion by six members, representing various phases of engineering, showed that much engineering work is obtained from other consultants. As pointed out by President Harold King, the purpose of the meeting was to acquaint members with the types of engineering work represented in the Association and the problems encountered in the various phases of the profession.

Panel members were James Kenney, of Sandberg-Serrell Corporation, representing research and development; Sheldon W. Swickard, electrical; Ray O. Maurseth, soil mechanics; Lester R. Kelly, mechanical engineering; S. B. Barnes, structural; and Frank E. Alderman, civil. Each panel member described his firm's structure (individual, partnership, or corporation); the engineering services offered; and typical jobs.

Sources of engineering work revealed some interesting facts. As expected, structural, mechanical, and electrical engineers derive most of their work from architects. A substantial part of soil mechanics work also is done for architects. On the other hand, a research and development company like Sandberg-Serrell usually deals directly with industrial concerns.

Each panelist discussed his engineering fees. The wide variance pointed up the difficulty of establishing any uniform fee schedule. Though much progress has been made in developing fee standards for structural and civil engineering work, even in these branches of engineering there probably always will be variances. In other engineering fields — soil studies, for example — Ray Maurseth said the cost of drilling and other difficulties encountered were considerations in fee negotiations. A common complaint was the tendency for some architects to take jobs at too low fees, expecting the consultant to also reduce his fees to bail out the architect.

On certain jobs, client education after the job is completed is part of the cost. Lester R. Kelly told of an air conditioning job where he spent a lot of time trying to satisfy an important member of a client's staff only to discover that the complainant's

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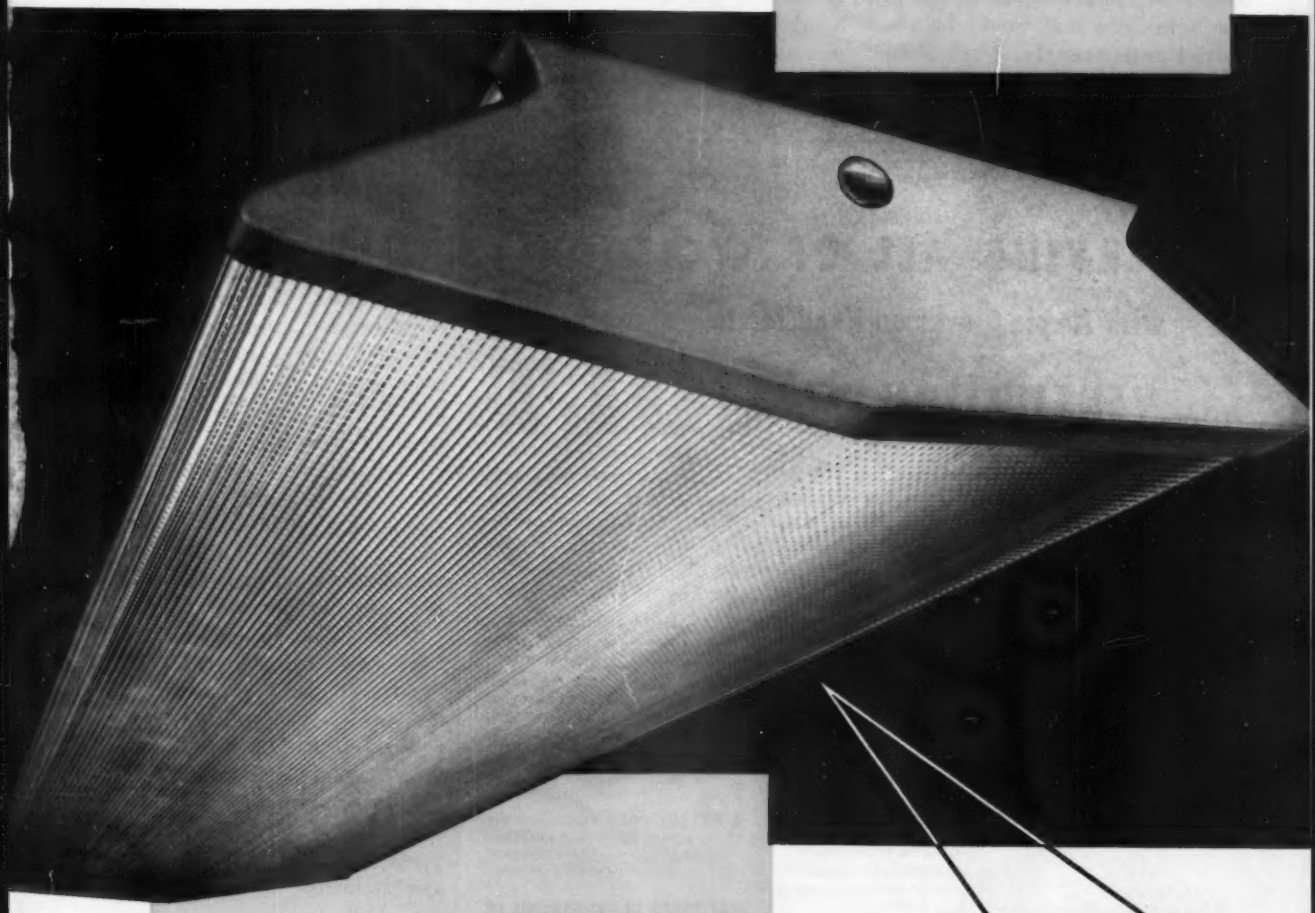

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real trouble was that he needed medical attention.

San Francisco CEAC Meeting

A discussion of fees highlighted the June CEAC meeting in San Francisco. George R. Keller, mechanical engineer, believes that conditions vary so widely it is difficult, if not impossible, to develop an equitable fee schedule that would be observed consistently. Mark Falk, structural engineer, feels a satisfactory fee schedule could be worked out, but because all engineers do not arrive at their overhead on the same basis, there would be some difference of opinion about a proper minimum fee. Lyle E. Patton, electrical engineer, brought up the variable factor of fixed charges and overhead and the difference in size and type of organization. He deprecated the hourly basis for fees, except where unusual conditions make it difficult to use a percentage fee basis: "Engineering personnel require greater skills than the ordinary carpenter, plumber, or electrician and should not be hired out on an hourly basis for all work."

Oregon Activities

The Consulting Engineers Association of Oregon has a workbook available for members which includes a detailed study made by the fees and services committee headed by Lloyd Clark; also included are suggested agreement forms, and tips on selecting a consulting engineer.

The new CEAO directory, distributed to Oregon banks, industrial concerns, and CEAO members, is a big hit, according to Chet Kershaw, public relations committee chairman. The committee has recommended employment of a part-time secretary to take over some work of the elected secretary, and has suggested setting up a speakers' bureau.

To improve engineering educational standards, the technical and education committee has investigated possibilities of working with high schools, colleges, and university extension divisions.

The legislation committee, Harry Czyzewski chairman, has collaborated with the Professional Engineers of Oregon on proposed revisions of the Oregon engineers' law. In conjunction with AIA, the committee has suggested a revision to make it legal to have practicing partnerships of consulting engineers and architects.

Washington Activities

The Consulting Engineers Association of Washington has selected new officers: chairman, Harrison Kramer, of Carey and Kramer; secretary, Paul Isaac, of Hammond, Collier and Isaac; treasurer, Allen Hill, of Hill and Ingman; directors, C. M. Barr, of Marshall, Barr and Associates; W. O. Stevens, of W. O. Stevens and Company; R. H. Shairer, of Bouillon, Griffith and Christopherson; and Harold Waller, of Hubbell & Waller, Inc. ▲▲

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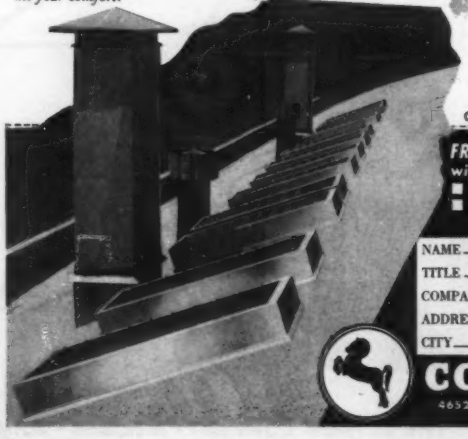

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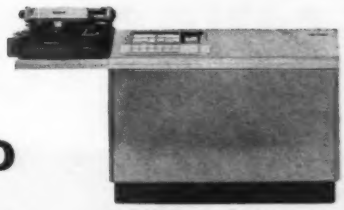

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Feature	Computer A	Computer B	Computer C	Computer D	LGP-30	
Memory Size	220 words for data only	2160 words	1000 or 2000 words	84 words for data only	4096 words for data & program (either or both)	LARGEST CAPACITY IN ITS CLASS
Max. Speed Add Multiply	 20/sec. 4/sec.	 Comparable to LGP-30	 Comparable to LGP-30	 3/sec. 1/sec.	 Over 440/sec. Over 50/sec.	SPEED EQUAL TO MANY ROOM-SIZED COMPUTERS
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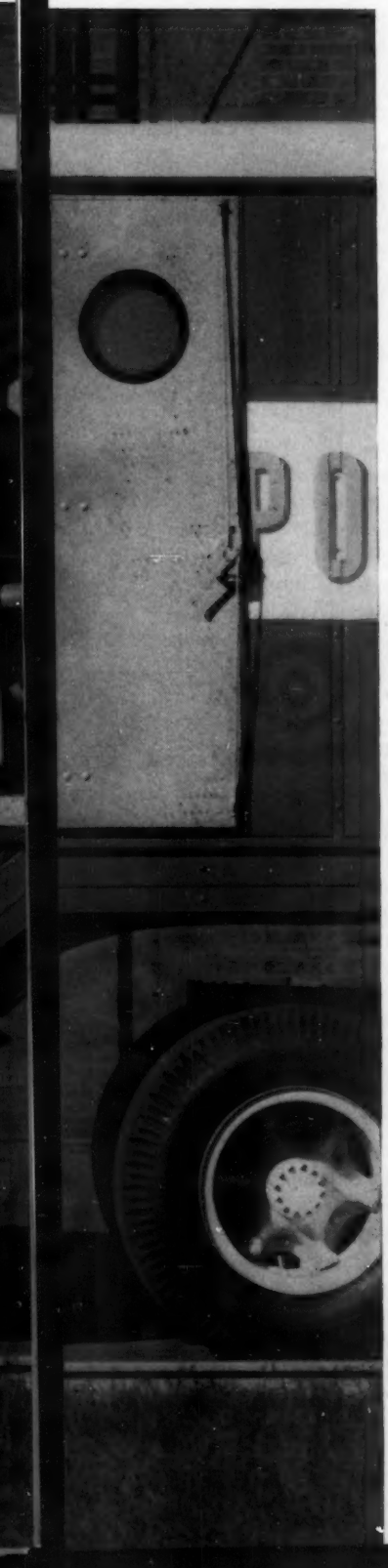

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Atoms in Action

JOHN F. LEE
Broughton Professor of Mechanical Engineering
North Carolina State College

THIS ATOMIC AGE is an age of research, and the role of universities in contractual research and consulting engineering services has become a matter of growing concern for educators. Nearly all are agreed that distinguished contributions in research are not only essential to the success of educational programs but constitute a direct obligation of the university. Furthermore, most engineers and scientists would agree that the faculties of professional schools should have practical experience in the practice of the professions they teach. The disconcerting element is the changing character of research in the universities and the type of engineering services rendered by university faculties.

A university not only is charged with the responsibility for instruction in known truths, but it has an equally important obligation to seek new truths – through research. Both faculties and students form a partnership in the critical examination of existing knowledge and in the pursuit of new knowledge.

However, there can be no justification for research as a faculty hobby, as a subsidiary business activity not intimately related to the school's educational mission. The only justification for the departure of universities from their historic approach to research is emergency defense work taken on when commercial resources are strained beyond capacity. Despite this, many universities have been misled into mammoth peacetime programs in "hardware" research and engineering development.

Big-time research has replaced big-time football on many campuses. Often the research programs and even the research staffs are in no way connected with the educational work of universities. The incentive is no longer patriotism but income. Some campus researchers not only pay their own way but indirectly support several other faculty members not engaged in research. At some schools faculty members and graduate students are organized in research teams similar to those of commercial research and governmental crash programs. The affability, budgetary skill, and organizational ability of the director of these projects is more important than his creative talent.

Classified Research Projects

Many universities have engaged in classified government research. Student and faculty participants in classified projects must have security clearance and, of course, any discoveries can never be mentioned in the classroom. These classified research projects on a university campus represent the most drastic departure from the historic mission of free universities. The atom, one might say, has brought about mutation in the character of educational institutions.

The presence of hardware and applications research as well as engineering development work on university campuses is detrimental to the universities themselves, to the national strength, and to the industrial community. Society always has expected the universities to develop and support people who are capable of independent and creative thought . . . men working without a pressing predilection for short-term objectives. Universities should concern themselves with basic eternal truths

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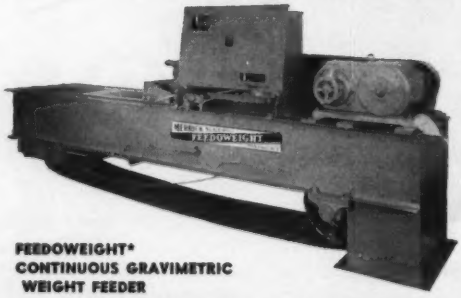

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learned from the past and seek truths which will have eternal values in the future. New basic truths can be sought and found only in an environment that places a premium on the inspired work of individuals and not on the conformity of a team approach to problems of short-term value.

The de-emphasis of basic research not only threatens the welfare of the universities and the nation but an emphasis on the pecuniary rewards of contract research can be as subversive to the moral strength of a university as is the flagrant support of subsidized athletic teams. Furthermore, the unfair competition made possible by a tax-exempt or tax-supported position in areas of research and development which are more germane to an industrial corporation than a university is certainly detrimental to many industries and consulting firms.

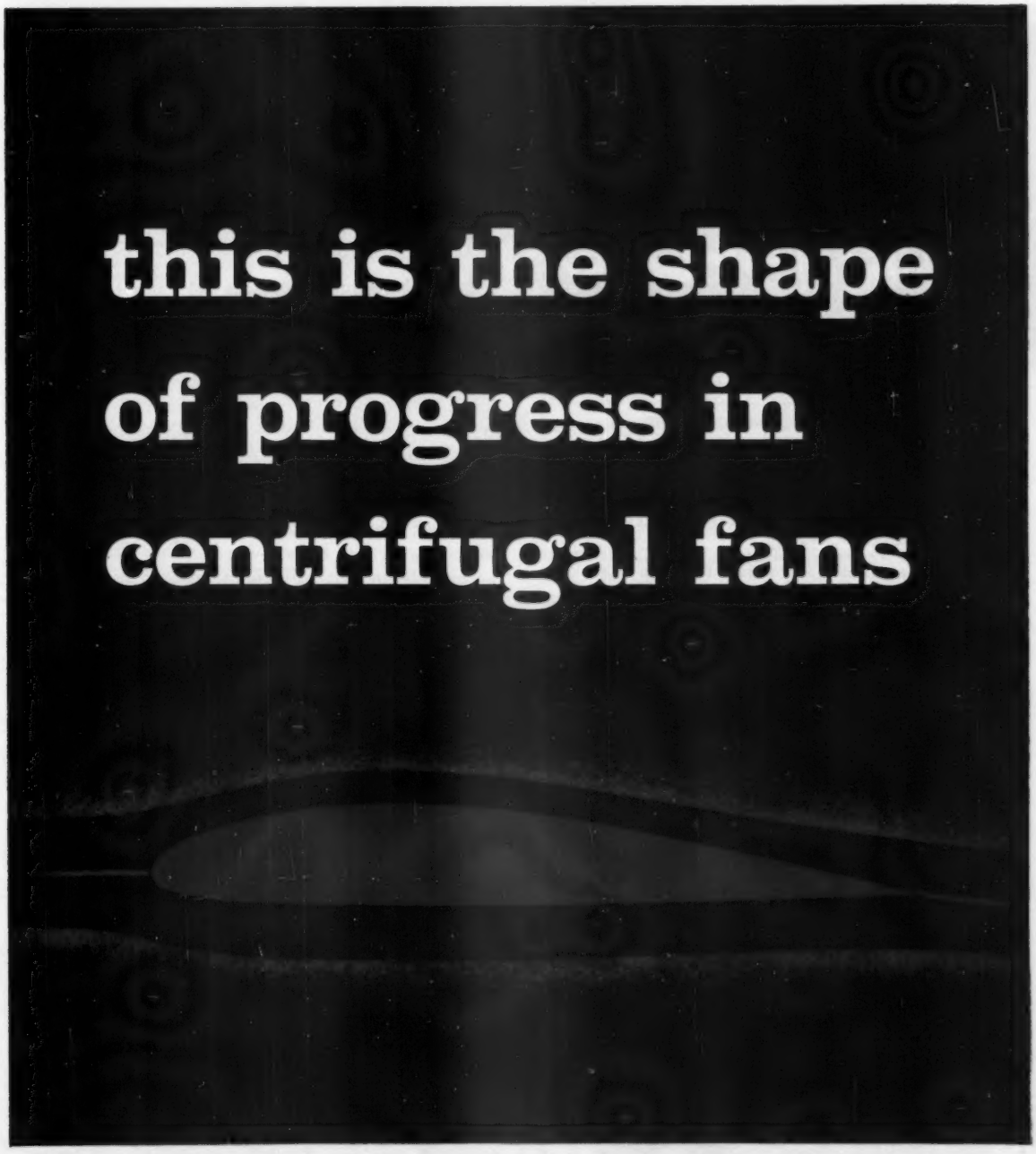
Monetary Considerations

While it is easy to condemn the universities for their excursions into the realm of industrial research and development, one can be considerably more sympathetic to the situation when the motivations are clearly understood. Comparatively few universities have adequate financial resources to support research for its own sake. Consequently, about the only way in which legitimate research can be supported is through the profit (euphemistically referred to as overhead) derived from contractual research.

It is also true that many universities could not retain competent faculties in engineering and science without the salary supplements made possible through contractual research budgets. Indeed, if it were not for contractual research budgets, the support of graduate students in many universities would be drastically reduced. Therefore the universities have been forced to continue and expand research activities into a business providing funds essential to their existence. Approximately 230 universities and colleges received in excess of $380 million just from Federal funds for support of research in 1956-57.

Industry and the nation have a vital interest in preserving and strengthening the universities as a source of basic research and as a supplier of research workers capable of independent creative thought. This vital interest can be protected only if industry, the Federal government, and the State governments contribute large sums of money to universities for the support of research. These sums of money should be contributed without regard to accountability except the certification by the institution that the funds were expended solely for research by the institution.

The choice of research endeavor should be left



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To take advantage of this *exclusive* offering, call your nearest Sturtevant Division Sales Engineer, or write Westinghouse Electric Corporation, Department J-1, Hyde Park, Boston 36, Massachusetts.

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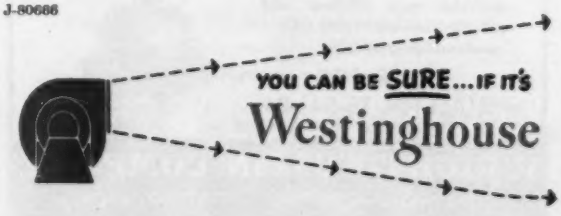

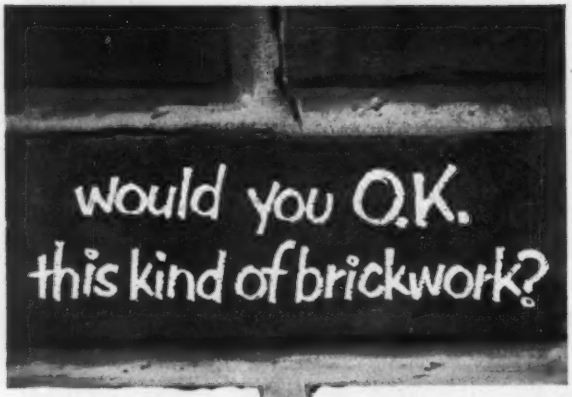

Obviously not. The mortar's shrinkage has left cracks that permit water penetration, resulting in leaks and efflorescence.

To prevent conditions like these . . . use Horn's Hydratite® PLUS. It retains the mixing water in the mortar, reduces absorption by bricks. This allows the mortar to develop full strength, adhesion and bond to masonry. The results? You control shrinkage, prevent leaks and efflorescence.

To make concrete, stucco or cement plaster mixes water repellent . . . use Horn Hydratite in liquid or powder form.

Like to know more about the Hydratites? For condensed data see Sweets—for complete A.I.A. specifications, write Dept. H55-9 29.

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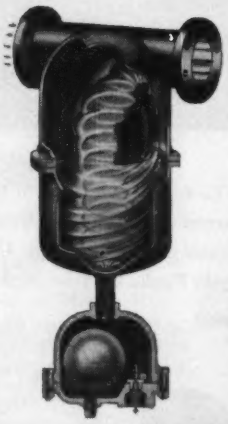
New Design Assures Maximum Entrainment Removal With Low Cost "T" Separator

Redesigned annular passage increases centrifugal force. Separated moisture, oil and solids travel outer wall to lower collecting chamber. Large diameter, high level outlet reduces velocity, eliminates entrainment problems. Screwed ends ½" thru 3". 125 lbs. flanged ends 2½" thru 8". Low cost in-line installation.

Combined with No. 90AC automatic drain trap to prevent loss of steam, air or gas provides most efficient and economical separator-drain combination available.



WRITE FOR BULLETIN TB-541-B

WRIGHT-AUSTIN COMPANY
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to the faculties with only the internal approval by the institution required. There should be no direct or indirect pecuniary advantage to a faculty member participating in research, but this requirement would have to be supported by the assurance that faculty members would receive salaries comparable to those of professional people of equal caliber in the industrial world. This is a large order – but until it is filled, universities will continue to expand in the research business.

Competition Still a Problem

Turning now to the matter of professional services offered by university professors in direct competition with the consulting engineer, there are many areas of consulting activity where a professor is not only noncompetitive but is essential to practicing consultants and engineering firms. In any event, the right and obligation for the teacher of a profession to practice his profession cannot be abridged. The real problem is the professor who offers his services for a lower fee than that usually acceptable to regular practitioners. This type of behavior is obviously unethical. It is also unethical for the professor to use university equipment and student help in competition with consultants, who must pay for the use of equivalent equipment and must pay full wages to employees.

From the university's standpoint, the extensive participation of a faculty member in the performance of routine engineering tasks, where financial gain is the principal motivation, constitutes a serious threat. This activity not only contributes nothing to the professional development of the faculty member but it represents a serious diversion of his interests and energies. However, the professor who exercises unique or unusual talents directly associated with his interests as a teacher in the performance of engineering services not only renders a valuable service to his client but enhances the effectiveness of his teaching as well. This type of public service not only is welcomed in a university, but it seldom arouses objections from practicing engineers.

These two problems, the university in competition with research laboratories and the professor in competition with the consultant, are yet to be solved. Both existed before the War, but only to a limited degree. It was the work of the universities in atomic research that pointed out to them the financial advantages of applied research for government and industry, and it was the shortage of engineers during the War that greatly encouraged faculty participation in engineering design and consultation. The solutions are not simple, but it will be a step forward if we recognize the existence of the problems. ▲▲

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greater heat transfer efficiency
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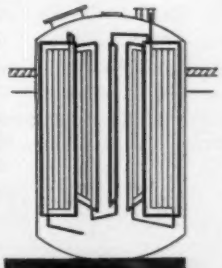
Stainless steel PLATECOIL units remove heat liberated in synthetic rubber polymerization reaction at the Torrance, California plant of Shell Chemical Corporation.

High efficiency, low cost per unit surface, ease of cleaning and improved agitation are cited as benefits obtained through use of PLATECOIL in this application.

The PLATECOIL units were fabricated into vertical banks which appear in the photo taken looking down into the reactor. The other photo shows the top of the reactor with PLATECOIL units in the foreground before installation.

Tranter PLATECOIL units are available in a variety of metals and finishes, in factory fabricated banks and in styles rolled to specified diameters to conform with the curvature of tanks or vats.



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IMPORTANT NE STEEL JOIST

1 DESIGN

Architects and engineers now are offered all types of SJI Approved open web steel joists, based upon 20,000 psi working stress. Open web steel joists approved by the Institute are thus in balance with all other steel used in structures. Greater economy and a more efficient use of steel results.

2 COMBINED SPECIFICATIONS

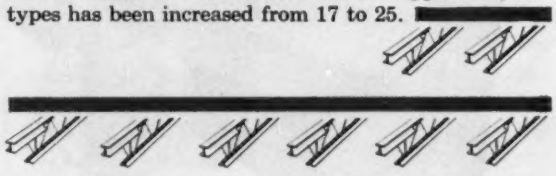
Specifications and load tables for all types of open web steel joists are combined in one handy reference for the designing architect and engineer. "S" series and "L" series joists uniformly designed are covered in this one over-all standard specification.

3 NEW SIMPLIFIED MARKING FOR OPEN WEB STEEL JOISTS

To simplify the designation and type mark of steel joists of all types and spans, a uniform system of marking has been adopted. The depth and series identification is incorporated in one type mark to give the designer a uniform system for identification. For example, an "S" series joist, formerly identified as type SJ102 will now be known as 10S2, or a 10" deep joist of the "S" series and a #2 chord section. A joist identified as 24L06 is a 24" deep, "L" series joist of a #6 chord section.

4 EIGHT ADDITIONAL TYPES

To provide greater flexibility and a more exact application of open web steel joists for given structural loads, the "S" series of Steel Joist Institute Approved joist types has been increased from 17 to 25.



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Steel joists of the designations adopted by the Steel Joist Institute and manufactured by the following companies have been investigated and approved by the Steel Joist Institute:

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BETHLEHEM STEEL COMPANY
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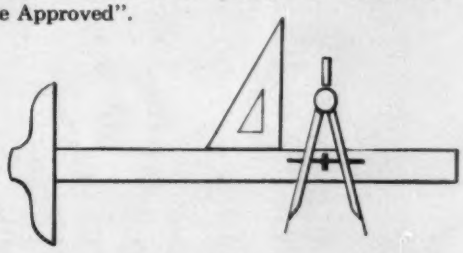
SHEFFIELD DIVISION
Armco Steel Corporation
SOUTHWEST STEEL PRODUCTS
TRUSCON STEEL DIVISION
Republic Steel Corporation
VIRGINIA STEEL COMPANY

WS FROM THE INSTITUTE

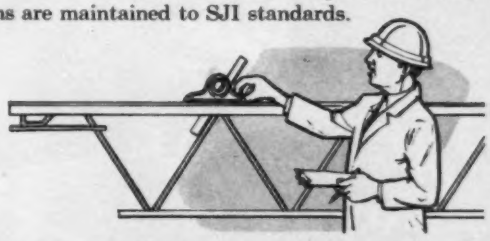
5 ENGINEERING DESIGN CHECK . . . "L" SERIES

To assure designers and specifiers of "L" series open web steel joists of proper uniform design properties, an engineering design check on such joists has been developed by the Steel Joist Institute and will be required before a manufacturer is permitted to indicate his product as "Steel Joist Institute Approved".



6 QUALITY VERIFICATION PROGRAM . . . "S" SERIES

A Quality Verification Program on all Steel Joist Institute Approved "S" series open web steel joists assures designers and code authorities that these structural members have not only been checked for design and load bearing ability but are subject to a continuing program of inspection by an independent laboratory at the Steel Joist Institute member company plants, to provide assurance that actual fabrication and production conditions are maintained to SJI standards.



7 NEW LOAD AND SPACING TABLES

Although the SJI Approved open web steel joists to be manufactured under the new SJI Standard will not be available from member companies before January 1, 1959, a new comprehensive load and spacing table is offered the architects and engineers for use as of October 1, 1958. This will permit inclusion of the construction economies of the new balanced design steel joists in many structures now in the planning stage.

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FREE! *Write for new standard specifications and load tables.*

See our insert in Sweet's Architectural File 2c/St

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☐ Please send me a copy of your new Standard Specifications and Load Tables.

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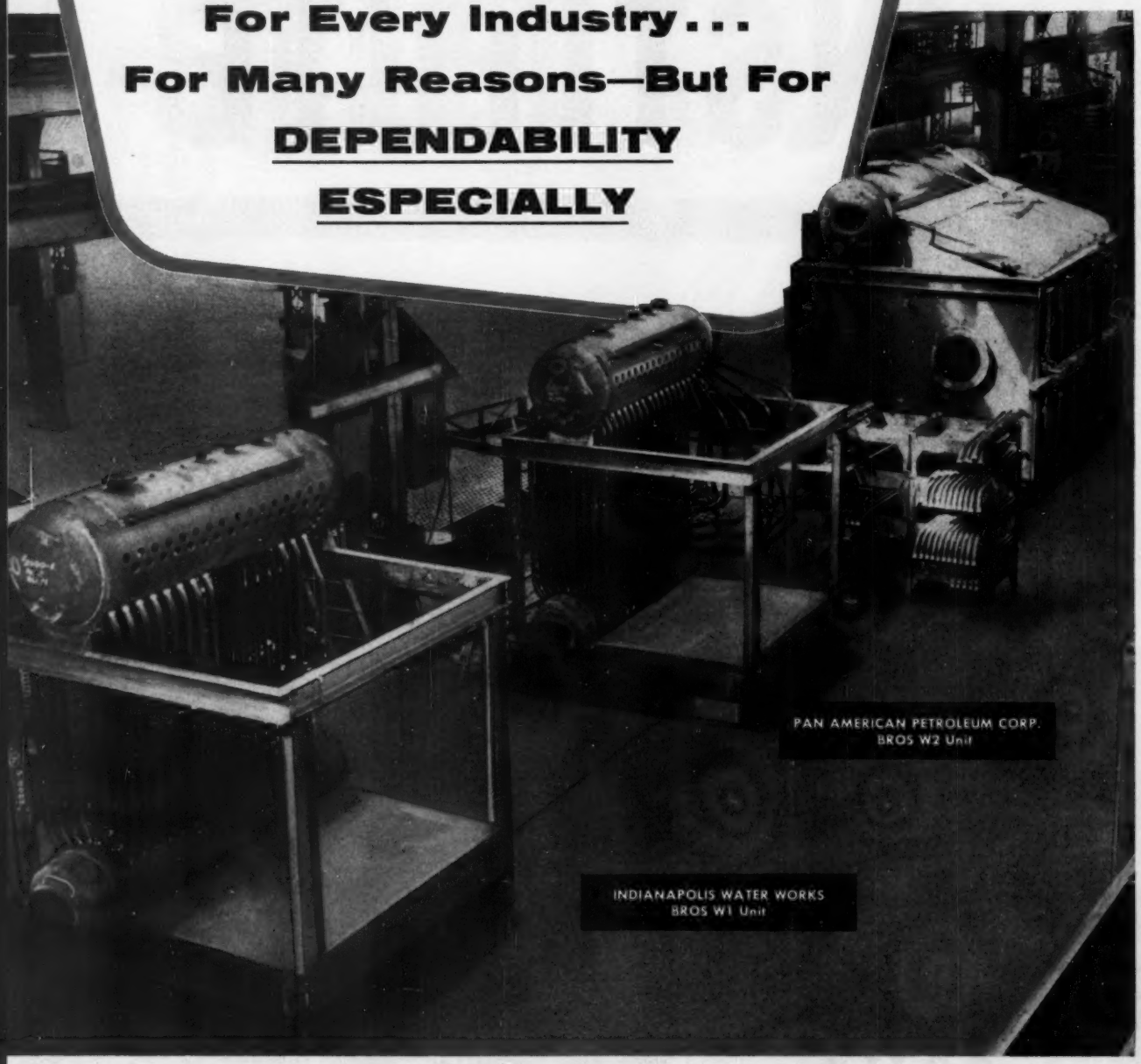

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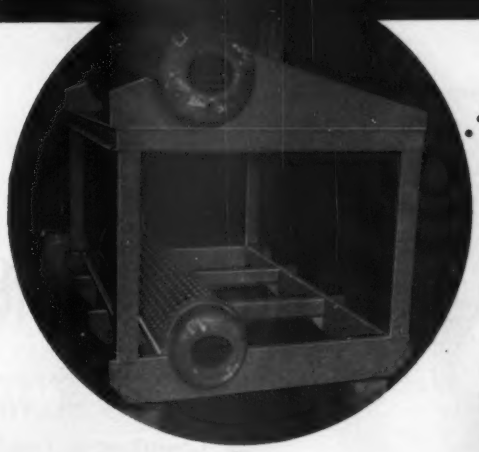

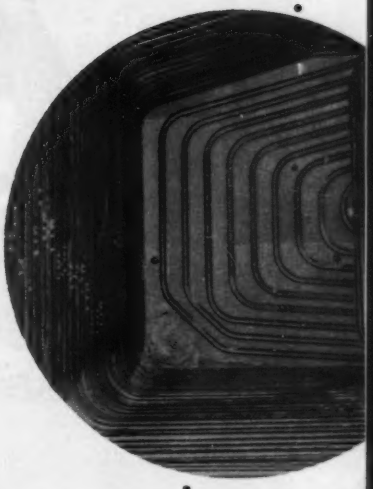

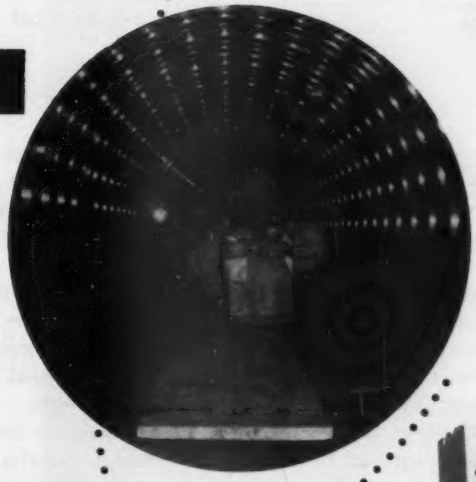

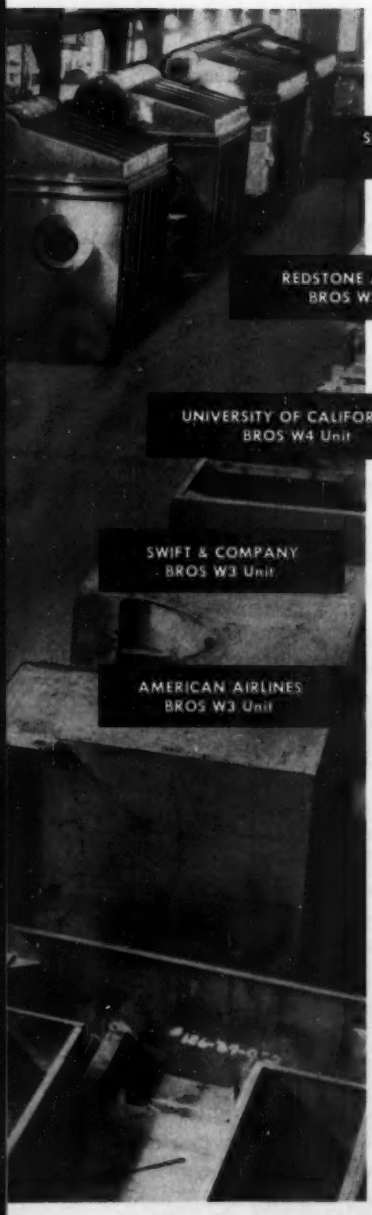

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Capacities range from 8,500 to 50,000 lbs. steam per hour at standard pressures up to 250 psi. Special units for higher pressures are available. Ready to go "on-the-line" with simple connections. Your choice of manual, semi or fully automatic controls. Fired with oil or gas or combination of both.

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POWER DIVISION

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The Legal Aspect

MELVIN NORD, P.E.
Consultant in Legal and Technical Problems
Patent Attorney

The Law of Real Property: Estates in Land

THE OWNERSHIP OF LAND may be divided according to space. It also may be divided according to time. Thus, ownership of land becomes four-dimensional.

The Doctrine of Estates

The division of real property rights according to time is called the doctrine of estates—a distinctive feature of the law of property. Estates are of two varieties: possessory estates—those which are at present possessory interests in land; and future interests—those which are at present not possessory, but which may become possessory in the future under certain conditions.

To be distinguished from both of these are other interests in land which are inherently nonpossessary, not only at present, but also in the future. Such interests in land are not "ownership" interests or estates, but "rights in the land of another"—such as right-of-way across a neighbor's land. (This type of interest in land will be considered in a subsequent article in this series.)

Fee Estates

The most inclusive type of possessory estate is called an estate in fee simple. This type of ownership is characterized by the fact that it is inheritable, i.e., it passes by operation of law to the heir, unless the property is otherwise disposed of by will or has been disposed of during the life of the owner.

A fee simple absolute is an inheritable estate which is unlimited in time. On the other hand, a fee simple defeasible is an inheritable estate which may terminate upon the occurrence of a certain contingency. For example, it may be provided in a deed that if a building located on the land is ever used as a liquor store, the estate shall terminate and revert back to the grantor, or to some other designated person.

Life Estates

As contrasted with fee simple estates, a life estate is noninheritable; upon the death of the life tenant, the property reverts back to the grantor, or to some other designated person. Life estates frequently are set up in wills.

At common law, a widow was entitled to a life estate in one-third of the land which the husband owned in fee at any time during the marriage (unless she waived her rights when he sold the land to someone else). This right of the widow is called dower. It has been abolished by statute in some states, but remains in others.

At common law, a husband acquired at his wife's death a life estate in all the land which his wife owned in fee during the marriage, provided children had been born. This right is called curtesy. It has been abolished by statute in many states.

Leasehold Estates

A leasehold estate, or lease, is the least inclusive variety of possessory estate in land. At common law, leasehold estates were not inheritable; at the present time, statutes generally provide that they descend to the next of kin in the same way as personal property is distributed upon the death of the owner.

A leasehold estate which is to run for any fixed period is called an estate for years. An estate from period to period is a leasehold estate which runs from year to year, month to month, or week to week. It continues in force from period to period

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Explosion-proof PYLETS exceed code requirements and provide maximum protection for personnel and property against explosion and fire.

PYLETS are designed for quick, easy installation and convenient maintenance. Rugged construction insures a long service life.

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G-E SERIES Threaded cover junction PYLETS with any arrangement of

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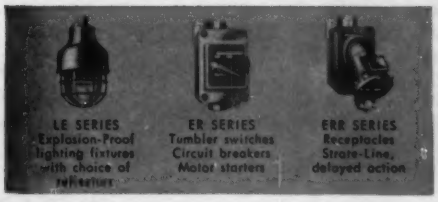

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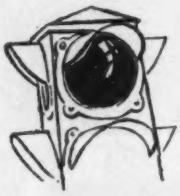

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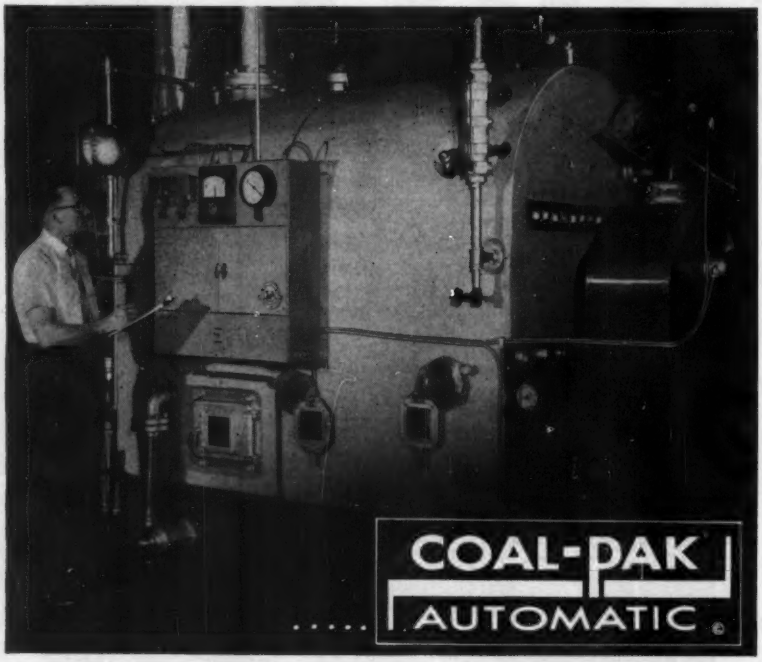

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until it is terminated by sufficient notice.

If a tenant holds possession wrongfully beyond the end of his term, he may be treated by the owner, at his option, either as a trespasser or as a tenant at sufferance. In the latter case, the tenant's possession is not sufficiently "adverse" to mature into title by "adverse possession."

An estate at will is a leasehold estate not fixed for any specified period. It is terminable at the will of either the landlord or the tenant.

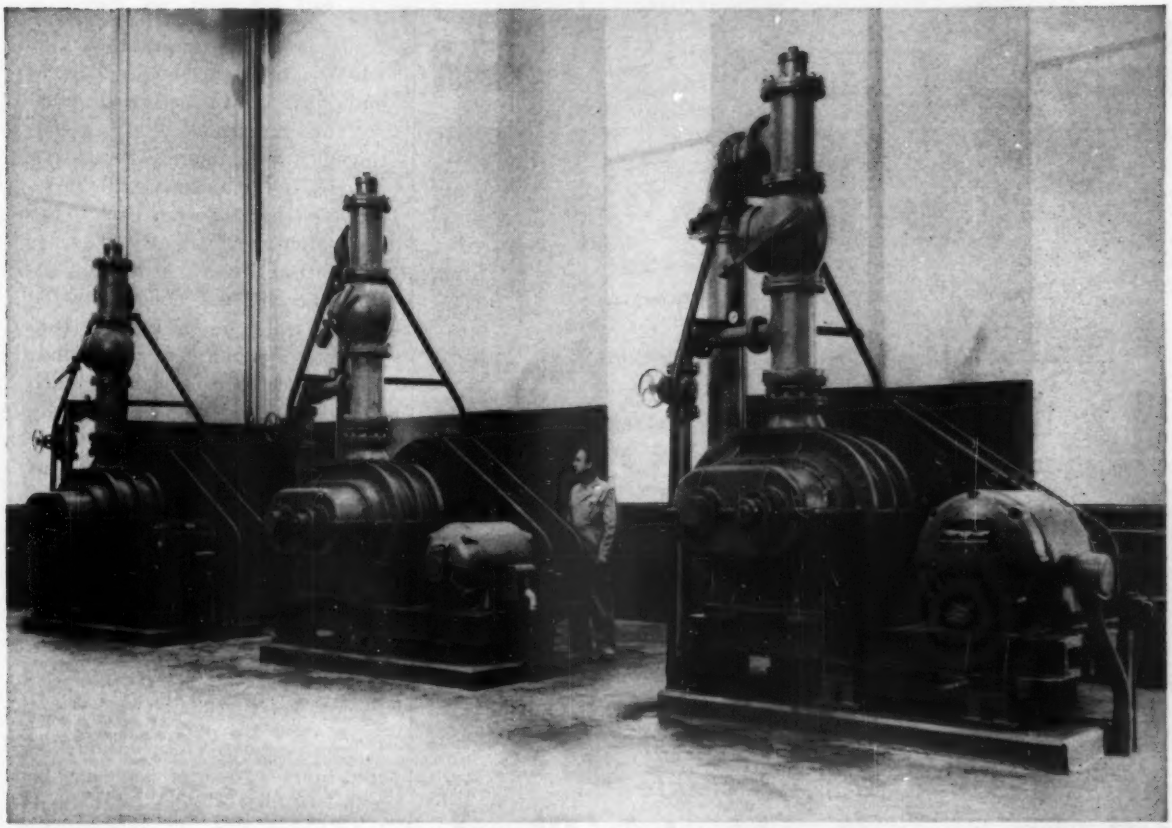
Future Interests

A future interest is an interesting oddity of the law of property. It is a general principle of law that a promise to transfer title to property in the future does not create any present legal interest in the land, but merely creates a contract right. On the other hand, it is possible at present to transfer a future interest in property, i.e., an absolute or a conditional right to obtain possession in the future. Legally, a future interest is a present estate, even though it is not to result in possession until some time in the future.

A future interest may be either vested or contingent. If it is vested, there is no condition attached to the right to take possession at the designated time. If it is contingent, there is a condition that must be satisfied before the estate can become possessory. A contingent future interest is something like an expectancy, but it is recognized as a property interest.

Contingent Future Interests

Once it had been decided that contingent future interests would be recognized as property interests, the problem arose as to what would happen if the contingency had not been determined at the time the prior estate terminated. Thus, suppose A granted a life estate to B, with a contingent future interest to C, provided C married. When the life tenant, B, dies before C is married, the question is whether



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You can depend on Sutorbilt Positive-Pressure Blowers and Gas Pumps to deliver clean, dry air or gas for many years, without costly maintenance and loss in efficiency. Reasons include precision-machined, wide-face herringbone gears, extra-rugged exclusive Sutorbilt timing hub, heavy-duty anti-friction roller bearings . . . closely-held tolerances throughout. Grease and oil seals, or in some instances, a five ring packing gland, insure integrity of air seal where shaft passes through the blower headplate.

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Onan ELECTRIC PLANTS

ELECTRIC PLANT NEWS

Onan ELECTRIC PLANTS

At the Elizabeth Kenny Institute . . .

Onan Standby Electric Plant keeps "iron lungs" operating

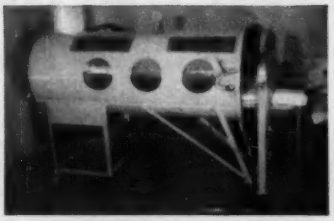
As many as 50 "iron lungs," one elevator, all essential lights, and power requirements for the boiler room are handled by the Onan 50KW electric plant during power outages.

Famed for its polio therapy, the Kenny Institute has patients in respirators at all times. The moment electric power is interrupted these patients will stop breathing . . . which makes immediate automatic starting of the emergency electric plant of vital importance.

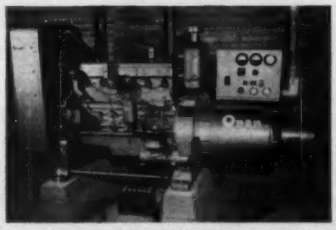
An Onan gas-powered electric plant was *specified* for this extremely critical installation. Onan gas or gasoline-powered plants, coupled with Onan line transfer controls start instantly and take over the power load *within seconds.*

Sizes for any hospital

Onan Emergency Electric Plants range from 1,000 to 150,000 watts A.C. In smaller hospitals where low initial cost is a factor, Onan air-cooled plants provide instant starting, dependable performance. Onan's Vacu-Flo cooling system eliminates complicated ducting. Automatic line transfer controls are available for all size plants.



50 respirators like this are operated by the Onan Electric Plant during power outages.



50KW Onan Model 50KA-4R8, installed adjacent to the boiler room at the Kenny Institute. Engine operates on natural gas.

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Onan ELECTRIC PLANTS

C's contingent future interest should be regarded as destroyed, or whether the law should wait to find out if C ever marries. At present, the answer is that C's contingent future interest is not destroyed. In the meantime, the property temporarily reverts back to the original grantor.

The result is that contingent future interests may conceivably be set up which might remain contingent for hundreds or thousands of years, or even forever, in which case land titles would be extremely confused. Thus, the famous Rule Against Perpetuities evolved. This rule limits the allowable duration of the contingency to a "life in being and 21 years thereafter." The application of this rule is an extremely interesting exercise in logic, which many engineers would find very entertaining.

Concurrent Estates

It is also necessary to consider that sometimes a piece of land may be owned not by a single individual, but by several people concurrently.

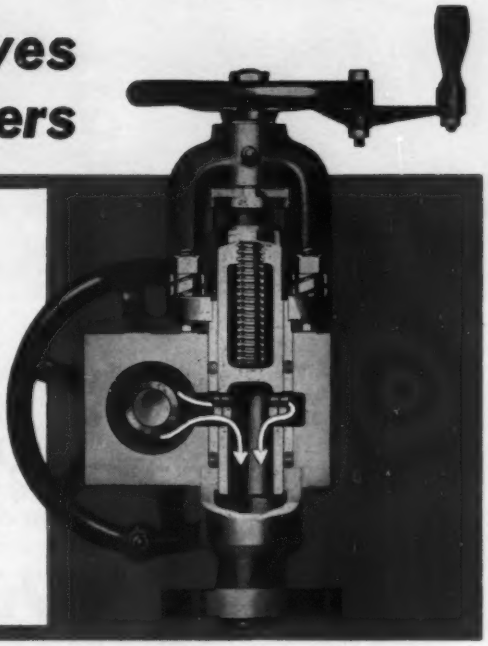
The most common type of concurrent ownership is called a tenancy in common. Each tenant is the owner of an undivided interest or share in the entire estate, and each tenant is entitled to exclusive possession against third persons, but is not permitted to exclude the other "tenants in common." The interest of each tenant can be transferred irrespective of the interests of the others.

A joint tenancy resembles a tenancy in common, except that when one of the tenants dies, his interest passes to the remaining joint tenants. Despite this right of survivorship, however, a joint tenant has the right to dispose of his interest during his lifetime. However, he cannot dispose of it by will.

A tenancy by the entireties is the same as a joint tenancy except that it can only be between husband and wife, and the right of survivorship cannot be broken by either spouse. ▲▲

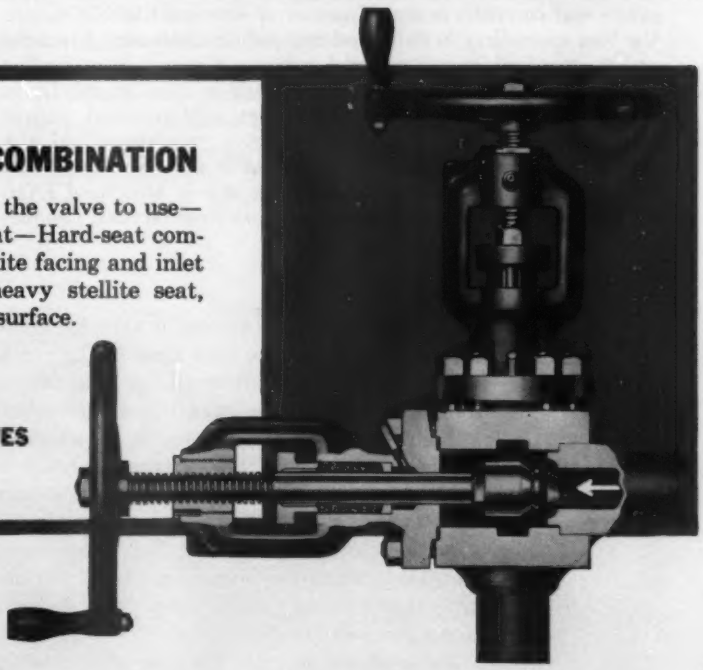
UNIT TANDEM

rugged blow-off valves for high pressure boilers



HARD-SEAT—SEATLESS COMBINATION

■ For boilers up to 1500 psi, this Yarway Unit Tandem Blow-Off Valve offers the maximum in dependable service. A one-piece forged steel block serves as the common body for the Yarway Stellite Hard-seat blowing valve and the Yarway Seatless sealing valve. All interconnecting flanges, bolts and gaskets are eliminated. The Unit Tandem at right is sectioned through Seatless Valve to show balanced sliding plunger in open position and free flow.



HARD-SEAT—HARD-SEAT COMBINATION

■ For boilers to 2500 psi, this is the valve to use—Yarway's Unit Tandem Hard-seat—Hard-seat combination. Disc has welded-in stellite facing and inlet nozzle has integral welded-in heavy stellite seat, providing smooth, hard-wearing surface.

OVER 4 OUT OF 5
HIGH PRESSURE PLANTS
USE YARWAY BLOW-OFF VALVES

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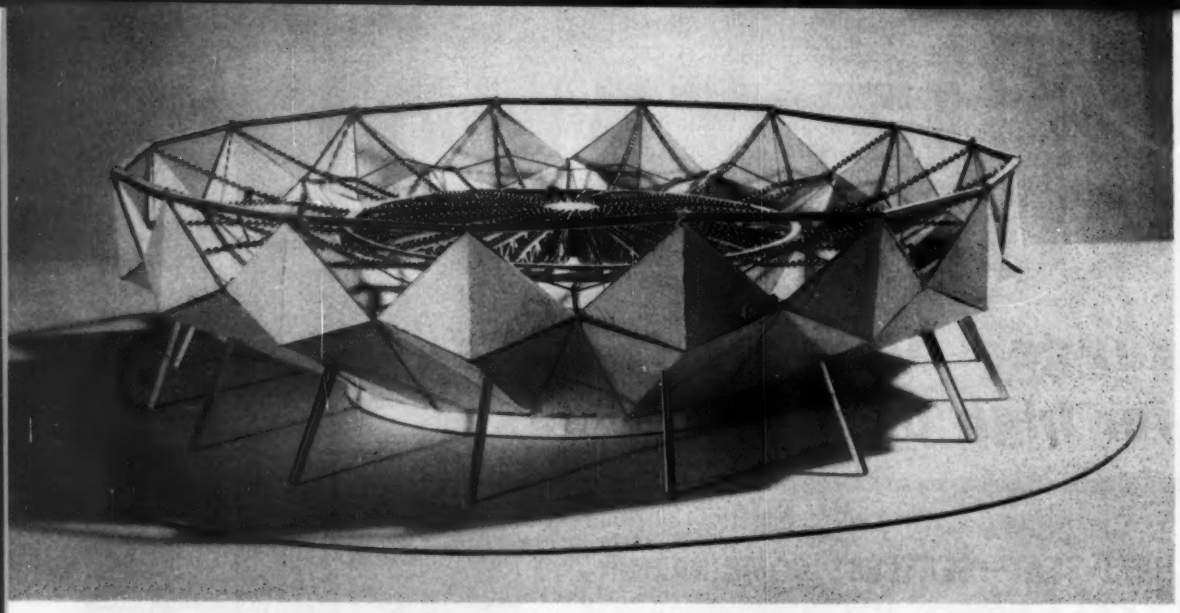


New Engineered Structures

With a civil engineering degree from the Norwegian Institute of Technology, in Trondheim, Fred N. Severud came to this country in 1924. He has been in private practice throughout his career and currently is senior partner of Severud-Elstad-Krueger. His firm specializes in industrial and public structures; television and theater buildings. Severud has lectured regularly at leading colleges throughout the nation, published a score of articles in engineering and architectural magazines, and received awards from such diverse groups as the Norwegian government and AIA (Allied Professions Metal, 1958). Severud is a member of ASCE, New York Association of Consulting Engineers, Structural Engineers Society of New York, and New York Architectural League.

FRED N. SEVERUD
Severud - Elstad - Krueger

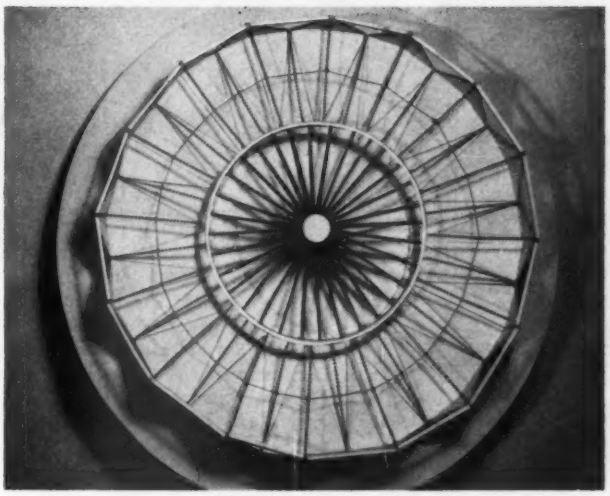
ONE MAN operating a crane is superior to an army of hod-carriers, so it is apparent the machine must take over most of the complex operation of putting up structures.

Recognizing the abilities of the machine, numerous prefabricated systems have sprung up. Some have been discarded because they were not adapted to modern techniques, which require ample allowance for inaccuracies and tolerances. But more and more components will be fabricated with heavy equipment.

I have been struck by the tremendous response that Italy's P.L. Nervi's work has stimulated. It would be hopeless to reproduce his structures in this country, for they are built with hand labor, but there is no reason why we should not build equally inspirational structures using machines. We are entering an era where spectacular structures will rise majestically from the ground, using the construction equipment at our command.

We must not fall into the trap of specializing in one construction method or medium; we must be alert to all materials and combinations of different materials and forms.

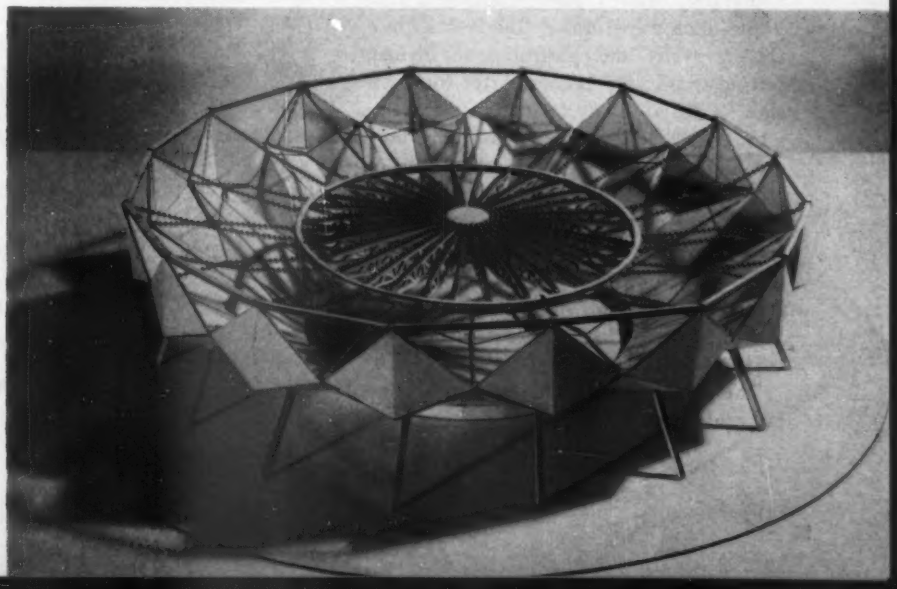
Coliseum



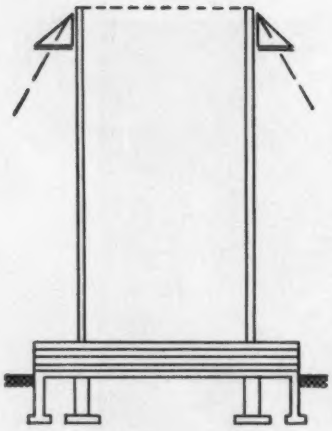
This coliseum (Vincent G. Kling, architect) consists of 32 two-fold folded plates forming a sawtooth roof line. Load-carrying cables are hung from the top of the teeth; snubbing cables prevent uplift from the bottom and provide drainage gutters. To minimize the sawtooth depth, snubbing cables have been raised above the load cables in the center portion. This center portion is constructed as a doubly curved bicycle wheel, so the cables inside this wheel can be spaced at will, and the two sets of cables arranged one above another.

Pulling supporting columns in from the edges relieves the compression ring, which is subject to heavy forces. Column bases will be adjustable so that raising or lowering the columns will produce uniform outward forces of the desired magnitude and direction.

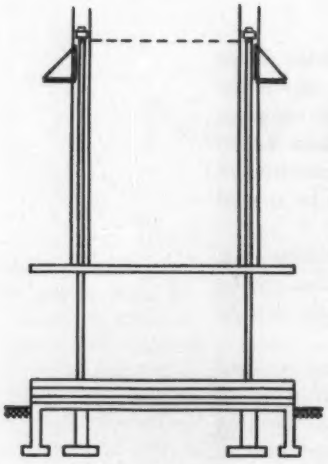
The seating arrangement has not been determined. It is tempting to strut up the seats from the concrete slab, creating a circular seating arrangement with the seat construction clearly visible. This would provide a huge cleaning gutter, and after the peanut shells and paper cups have been swept into it, it could be hosed down. Another possibility is to arrange seating in zig-zag fashion, following the horizontal lines in the folded plates.



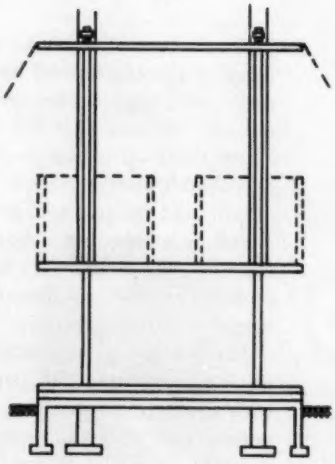
Lift Slab... With Precast Walls



After excavation, pour foundation and base slab, and backfill. Set vertical columns over concrete billets and guy. Place column collars and pour floor slabs over base slab, using a separating medium.



Erect 24-ft lift rods and building-height extension rods. Then lift roof slab over extension, rods remove extension rods and thread lift rods down to collars. Weld collars, raise and secure roof slab.

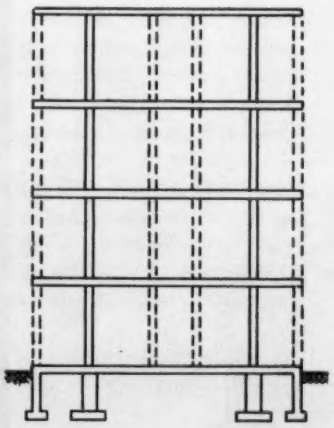


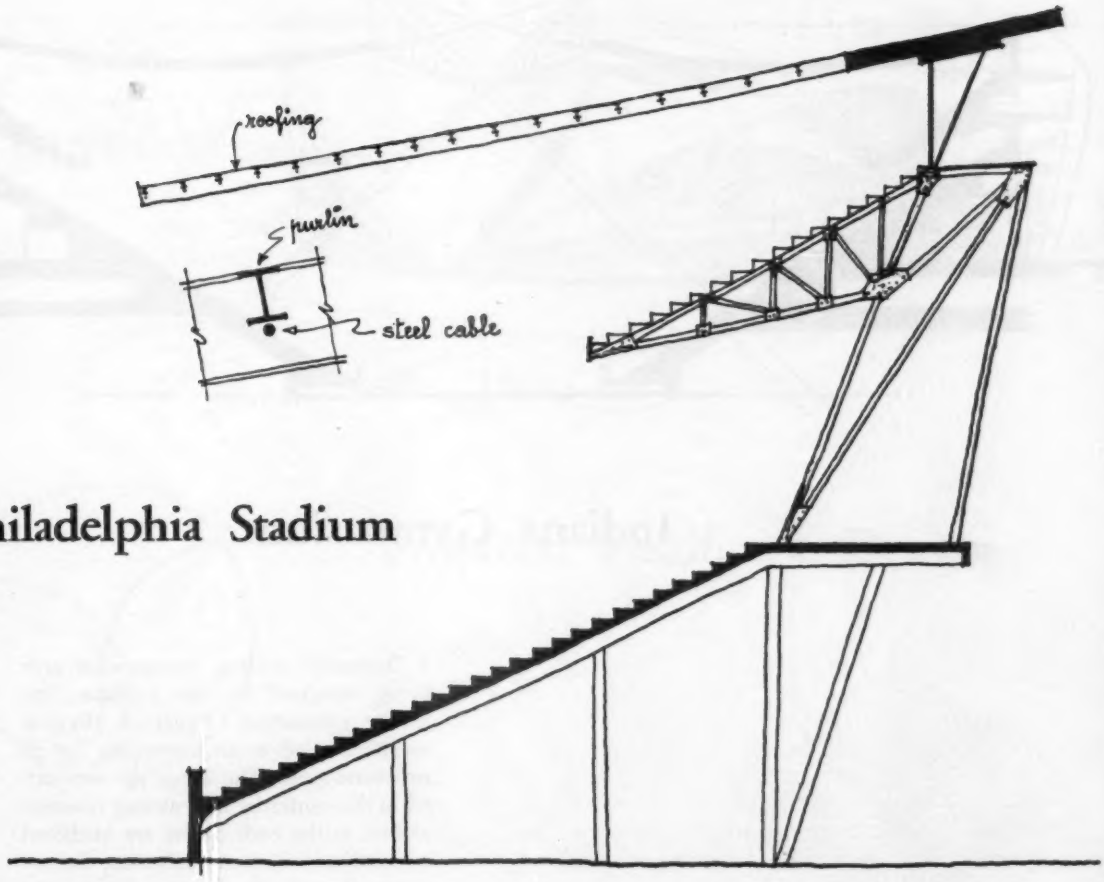
Set fourth-floor precast partitions in place and secure for lifting. Connect lift and extension rods to fourth-floor slab, then raise slab and weld column collars. Repeat these steps for third, second floors.

George Pavarini (Pavarini Construction Company) and I have combined the Youtz-Slick structural method with precasting walls and partitions in layers, setting these with cranes. After the roof slab is lifted away, partitions are set while the floors are on the ground. Then the floors—with the partitions on them—are lifted into position progressively. Because most work is done at ground level, the lifting technique is utilized more effectively than if only the slabs were lifted. In the first story the partitions must be set by fork trucks rather than by hoisting cranes.

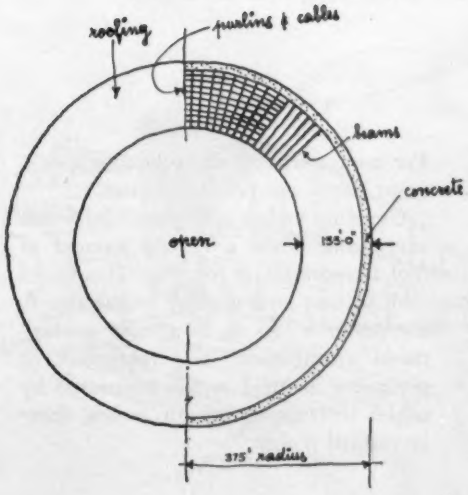
The idea has been analyzed in all detail and appears thoroughly practical.

With second-floor slab in place, remove jacks and guy cables. Then place the precast first-floor partitions in position using forklift trucks This method of construction should save time and money.





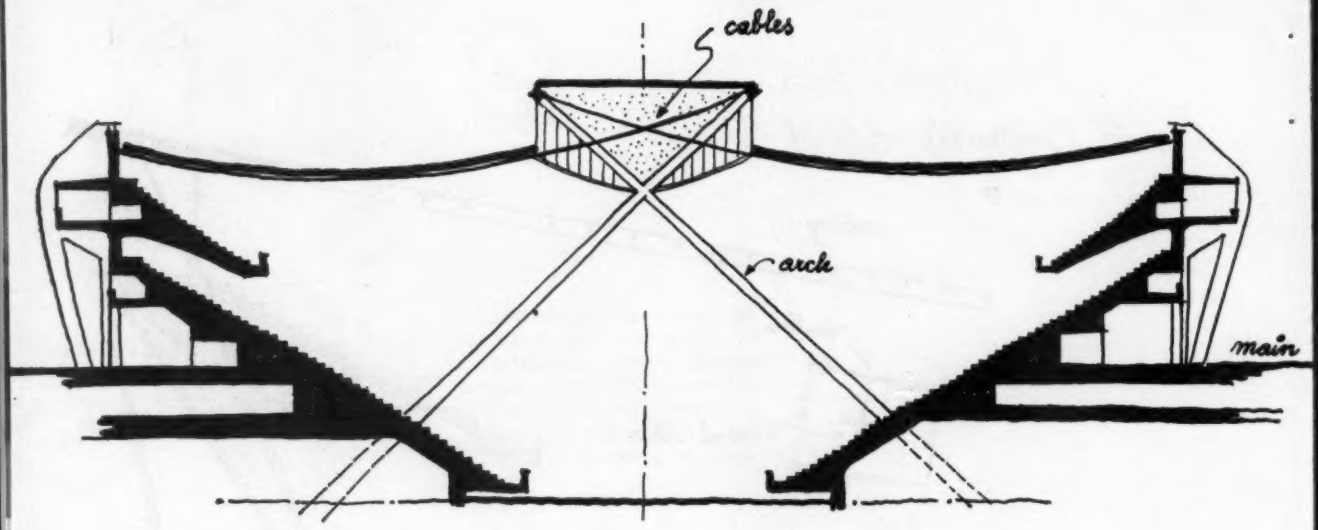
Philadelphia Stadium



A simple hung roof is used for this proposed Philadelphia stadium (again, Kling is the architect). The 140-ft cantilever roof is hung on 2½-in. round cables pulling on 24-in. WF beams. The 10-in. purlins above the cables create an inverted dome shape to resist wind uplift.

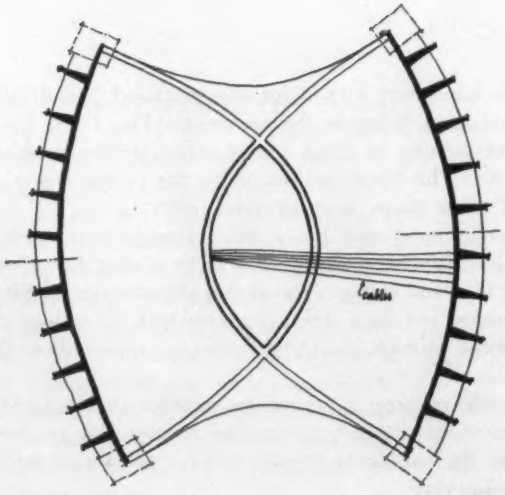
A circular hung roof has a disadvantage: it is hard to drain. One way to overcome this is to scallop the edges, creating hips and valleys. The sketch shows a system Kling and I worked out for a 400-ft diameter roof. To reduce the depth of the scallops, the valley cables are raised above the hip cables.

A double purpose is served by cantilevering a folded-plate construction, which the scallops suggest. You get more seats and the cantilever greatly reduces the forces in the compression ring.



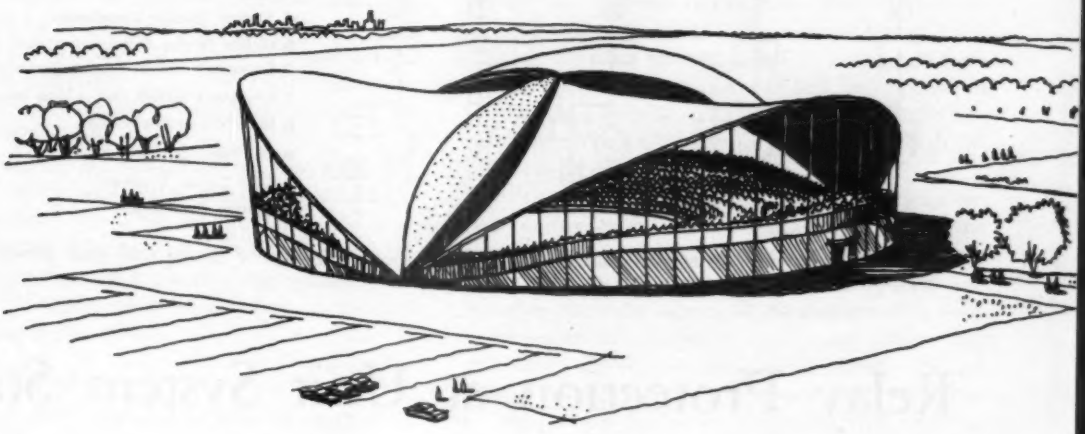
Indiana Gymnasium

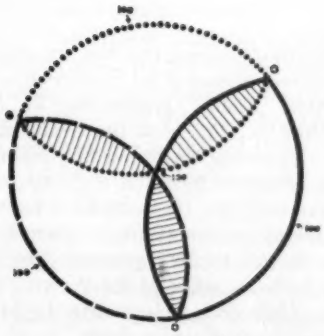
A "butterfly" seating arrangement now being designed for the Indiana University gymnasium (Eggers & Higgins, architects) led to an interesting logical structural form. The wings are supported in the center by intersecting concrete arches; at the ends cables are anchored to cantilever frames, delivering the reaction through the balcony beams into rock. The sketch shows the center cables anchored to the far end arches. However, it turned out to be more practical to run continuous cables hung from the arches.



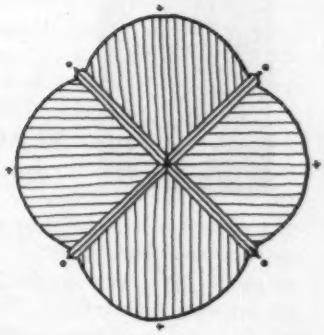
For some purposes, three or four arches (next page) are better than two.

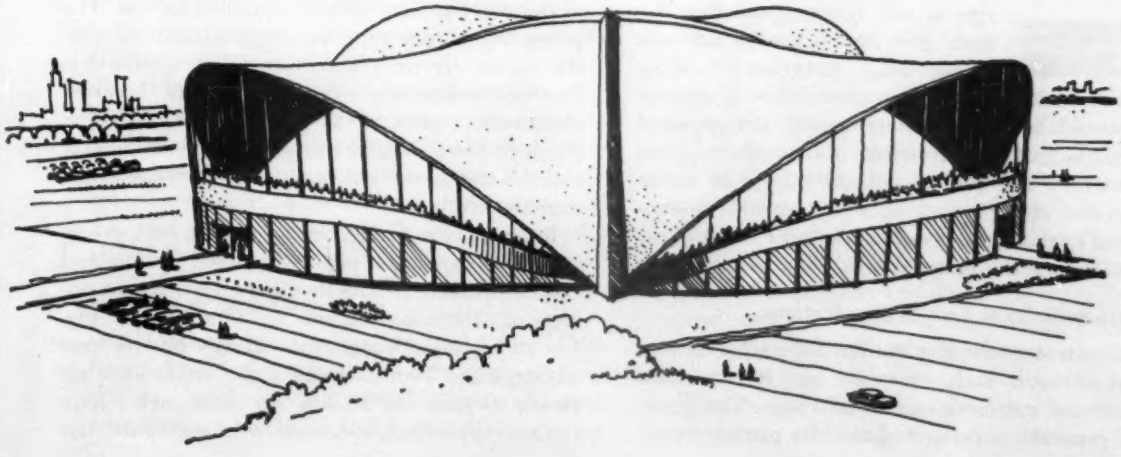
Crossing arches are particularly advantageous when a certain amount of roof fenestration is required. If a threefold seating arrangement is awkward, the designer can go to a more conventional arrangement, a combination of perimeter inclined arches connected by cables to crossing interior arches, these in vertical planes.





Proposed Fieldhouse Designs





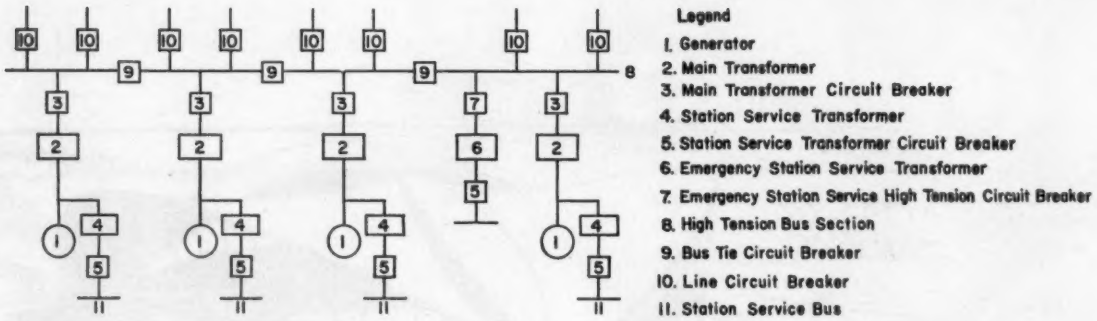

Legend
1. Generator
2. Main Transformer
3. Main Transformer Circuit Breaker
4. Station Service Transformer
5. Station Service Transformer Circuit Breaker
6. Emergency Station Service Transformer
7. Emergency Station Service High Tension Circuit Breaker
8. High Tension Bus Section
9. Bus Tie Circuit Breaker
10. Line Circuit Breaker
11. Station Service Bus

Fig. 1 – Diagram illustrates connections of a unit type multigenerator station with four generating units.

Relay Protection at Unit System Stations

VLADIMIR P. BRODSKY
Gilbert Associates, Inc.

Vladimir P. Brodsky's education has an international flavor. He first attended the University of St. Vladimir in Kiev, Russia, graduating in 1908. From 1909 to 1914, he studied at the University of Leige and the Electrical Institute Montefiore in Leige, Belgium, and was awarded a Certificate in Electrical Engineering. He then attended Carnegie Institute of Technology, receiving a Bachelor of Science degree in Electrical Engineering in 1924. In this country he has worked at the Westinghouse Electric Corp. (1918-1921), Duquesne Light Co. (1921-1928), and Consolidated Edison Co. of New York, Inc. (1928-1953). He has been with Gilbert Associates, Inc., Reading, Pa. since 1953. Mr. Brodsky is a registered engineer in New York State, and is a life member of AIEE.

CONSULTING ENGINEERS engaged in the design of unit system generating stations give careful consideration to proper relay protection. They specify back-up relays as a second line of defense to provide an additional safeguard, if equipment or system faults in the vicinity of the station are not cleared by first line of defense relays. At multigenerator stations back-up relays should be connected so that their operation does not result in the shutdown of the entire station.

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Characteristics of Unit System Stations

Unit system generating stations have solid connections between each generator and its associated power and station service transformers. The generator generally is connected to delta primary windings of the two transformers. Secondary windings of the two transformers are connected in wye. The power transformer supplies a high tension bus, and the station service transformer a low tension bus for the station auxiliaries. The circuit breakers electrically nearest to the generator are, therefore, the high tension main transformer circuit breaker and the station service transformer low tension circuit breaker.

In a unit type multigenerator station, each generating unit supplies a high tension bus section, and bus tie breakers are installed between adjacent bus sections. These connections are illustrated in Fig. 1 – a diagram of a unit type station with four generating units. Two outgoing high tension lines are shown on each bus section. An emergency station service transformer is connected to one of the bus

sections for starting the station initially or re-energizing it after an outage.

The type and arrangement of the generating unit connected to a section of the high tension bus will be governed by project requirements.

Fig. 2 is a single line diagram of a single generator and its associated protective relays. Units of this design, with liquid cooling, now are built in ratings up to 250,000 kva.

Fig. 3 illustrates a cross compound unit with two generators on separate shafts, one driven by a high pressure turbine, the other by the associated low pressure turbine. The generating unit also may be of the tandem type having a single generator with two windings on the same shaft driven by a common high pressure turbine.

Safeguards Important

With any of these types of generating units, it is necessary to provide safeguards for station equipment and electrical system power connections. This is the function of protective relays — an important consideration, particularly in view of the enormous increases in generating station capacities during the last two decades. Fortunately, considerable progress has been made in the development of new protective devices and improvement of previously developed relays.

In the event of electrical faults or abnormal conditions, protective relays initiate the opening of one or more circuit breakers in order to isolate the fault or abnormal condition, to minimize the damage to station equipment, and to maintain continuity of services from other generating sources or circuits. In a three phase grounded neutral system faults may be three phase, phase-to-phase, phase-to-phase-to-ground, or single phase-to-ground. Abnormal conditions are loss of generator excitation and load unbalance.

The character of system faults determines the design features of particular groups of relays. These in turn determine the mode of relay connections to secondary devices, such as current and potential transformers.

Protective circuits must be arranged so that they perform the desired relay operation under a particular fault or abnormal condition. However, a link in the protective relay circuit of the first line of defense may fail. It is, therefore, desirable to provide a second group of relays with a separate protective circuit to back up the first line of defense relays.

Relay Types and Functions

Generator differential relays and station service differential relays have two restraining coils and one operating coil on each phase. Main transformer relays, shown in Figs. 2 and 3, have three restraining coils and one operating coil. Secondary current transformer connections are arranged so that under normal load conditions, or in the event of an external fault, currents in the relay circuit will circulate in the restraining relay coils without going through the relay operating coil. If an internal fault occurs, the secondary currents will be unequal or will be in opposite directions; consequently the resultant of the two currents will pass through the relay operating coil.

To compensate for a 30-degree displacement between currents on the delta side and those on the wye side of a transformer bank, current transformers on the wye side must be connected in delta, and those on the delta side must be connected in wye.

Schematic connections in Figs. 2 and 3 show that generator differential relays and differential relays on station service transformers are a first line of defense for faults in equipment protected by these relays. Main transformer differential relays are a first line of defense for faults in the main transformer or in leads from the main transformer to the generators and station service transformer. These relays are also a second line of defense for faults in the generators and the station service transformer. In this respect, they might be called over-all differential relays.

The bus differential relays shown in Figs. 2 and 3 are energized by current transformers connected in parallel. Bus differential relays of a different type, based on a different principle, are energized from air cored mutual reactors wound on nonmagnetic toroidal cores such that the adjacent circuits will not induce any unwanted voltages. Differential relays of this type have voltages in series connection instead of currents in parallel. The resultant voltage will be zero under normal conditions or when there is an external fault. In the event of an internal fault the resultant voltage will energize the bus differential relay connected in series with the reactor coil, and the relay will operate to clear the bus fault.

The ground relay (51GT) in the neutral of the main transformer is a second line of defense for ground faults on the high tension lines and station equipment. The ground relay (51GT) in the neutral of the station service transformer is a second line of defense for ground faults on station service equipment and power connections.

Loss of excitation relays (40) protect the station equipment and system against loss of generator excitation which may cause overheating of the generator rotor and severe system voltage reductions, resulting in reduced stability of other machines on the system.

Negative sequence relays (46) protect the generator against an unbalance in the system which, in

case of parallel lines, may be caused by mutual coupling or which may be a result of unbalanced fault conditions such as a phase-to-phase fault. Under unbalanced conditions, the generator stator current includes a negative phase sequence component, which sets up a counterrotating flux field in the machine; this in turn causes double frequency currents to flow in the rotor iron and slot wedges, resulting in excessive local heating. A negative phase sequence segregating network is provided in the relay which makes the induction-disc unit respond only to a negative phase sequence component of generator current. This relay is a first line of defense for load unbalance and is generally a second line of defense for unbalanced faults. It is not directional and therefore may be connected to the secondaries of current transformers on only one generator as shown in Fig. 3.

Both the neutral of the single generator (Fig. 2) and the neutral of the low pressure generator (Fig. 3) are grounded through similar distribution transformers. Connected across the secondary of each of these distribution transformers is a resistor and a low pick-up special voltage ground relay (64). This relay in effect serves as a ground fault detector at the generating voltage level. The contacts of this relay may be connected either to give an alarm or to trip the main transformer circuit breaker, if a ground fault is not cleared after a reasonable time delay.

The voltage balance relay (60) has one set of coils connected to secondaries of potential transformers for the voltage regulator. The other set of relay coils is connected to secondaries of potential transformers for the generator relays. The purpose of voltage balance relays is threefold:

¶ Blowing of a fuse on potential transformers for the generator relays will open the trip circuits of the main transformer circuit breaker and of the associated circuit breakers.

¶ Blowing of a fuse on potential transformers for the voltage regulator will remove the voltage regulator from operation to prevent it boosting the generator voltage too high.

¶ Blowing of a fuse on either set of potential transformers will give an alarm.

The impedance relay (21) is a generator back-up relay. This relay measures the ratio of secondary voltage impressed on the relay potential coils to the current in the relay current coils. This impedance relay is inherently directional; however, because of its special characteristics, it also will operate within a limited impedance in the reverse direction. It may, therefore, be connected

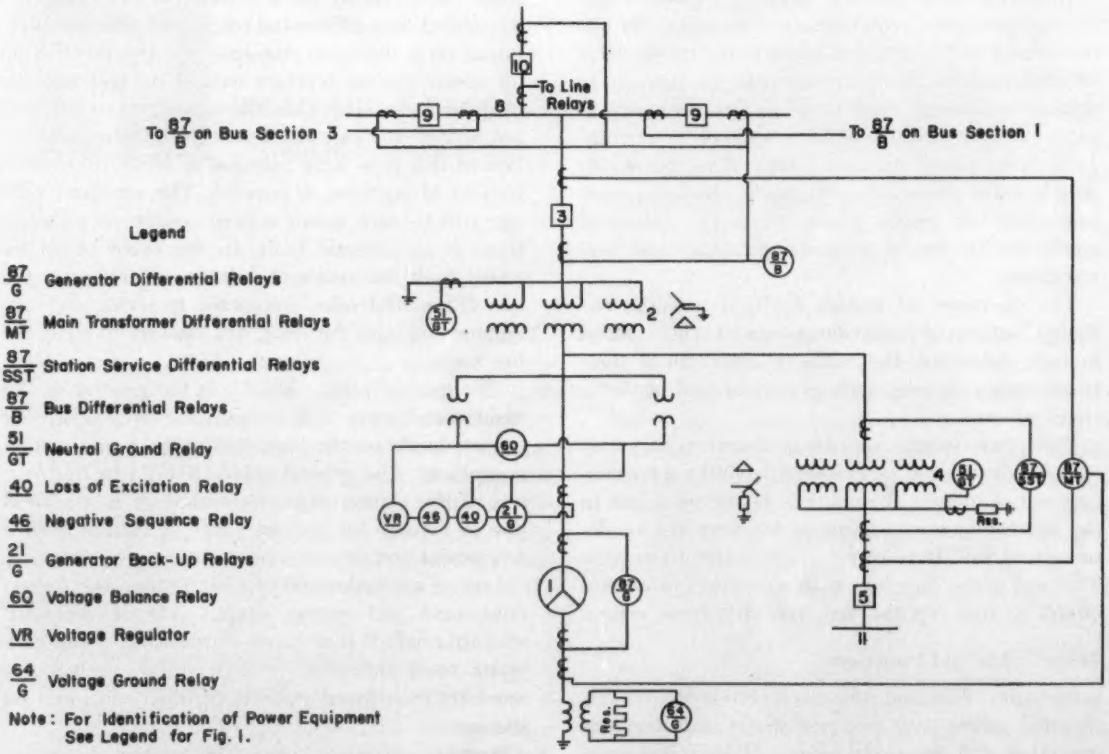
To Line Relays
To 87/B on Bus Section 3
To 87/B on Bus Section I
Legend
87/G Generator Differential Relays
87/MT Main Transformer Differential Relays
87/SST Station Service Differential Relays
87/B Bus Differential Relays
51/GT Neutral Ground Relay
40 Loss of Excitation Relay
46 Negative Sequence Relay
21/G Generator Back-Up Relays
60 Voltage Balance Relay
VR Voltage Regulator
64/G Voltage Ground Relay
Note: For Identification of Power Equipment See Legend for Fig. 1.
Res.

Fig. 2 – Line diagram of a single generator shows arrangement of system's associated protective relays.

to the secondaries of current transformers on only one generator. Since the relay is instantaneous in operation, an auxiliary timing relay is used with it.

Since the usual delta current transformer connections of impedance relays will not insure clearing phase-to-phase faults on the wye side of the power transformer, when the impedance relays are on the delta side of the power transformer, special current and potential transformer connections provide the equivalent of delta connected relays on the wye side, when reflected to the generator side of the power transformer. With these modified connections the relay will clear three phase faults on either side, but phase-to-phase faults on the delta side may not be cleared. Back-up protection for phase-to-phase faults on the delta side of the power transformer will be provided by negative phase sequence relays.

With all high tension bus tie breakers closed, if a fault is not cleared by relays of the first line of defense, the generator back-up relays will shut down the entire station. It is, therefore, desirable to use, with the generator impedance relays, the negative sequence relay, and the main transformer ground relay, a two-step timing relay. The first step trips the bus tie breakers to adjoining sections, and the second step trips the main transformer breaker and associated circuit breakers, if the generating unit still feeds into the fault after segregating the bus sections.

Negative sequence and neutral ground relays generally have inverse or very inverse time current characteristics. While most relays of this nature are not used with timers, this application is entirely satisfactory.

Under maximum generating conditions with all generators in service, this method of back-up protection will drop only one high tension bus section. Under minimum generating conditions with two or three generators in service, it will be possible, by introducing an operating set-up with ample flexibility, to drop not more than two bus sections.

A station with four generating sources, having similar thermal and electrical characteristics, may be operated as follows under minimum generating conditions:

¶ Two generators in service.

Open tie breaker between sections 2 and 3.

On sections 1 and 2, run generator 1 or 2.

On sections 3 and 4, run generator 3 or 4.

¶ Three generators in service.

Close all tie breakers between sections of the high tension bus. Run any three generators. ▲▲

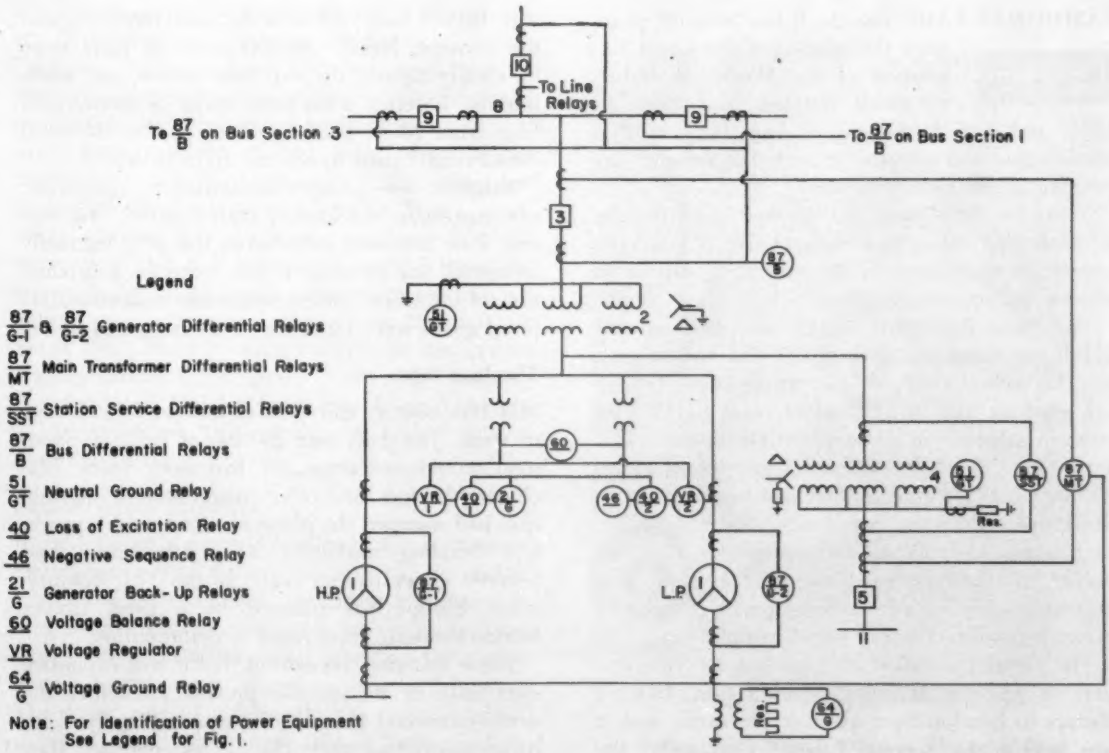
To Line Relays
To 87/B on Bus Section 3
To 87/B on Bus Section 1
Legend
87/G-1 & 87/G-2 Generator Differential Relays
87/MT Main Transformer Differential Relays
87/SST Station Service Differential Relays
87/B Bus Differential Relays
51/GT Neutral Ground Relay
40 Loss of Excitation Relay
46 Negative Sequence Relay
21/G Generator Back-Up Relays
60 Voltage Balance Relay
VR Voltage Regulator
64/G Voltage Ground Relay
Note: For Identification of Power Equipment See Legend for Fig. 1.
H.P
L.P
Res.

Fig 3 — Diagram of a cross compound unit with two generators on separate shafts showing protective relays.

The First World's Fair

DR. THOMAS P. HUGHES
Washington & Lee University

Crystal Palace on opening day, looking south under transept. Magnificent building burned on a November night in 1936

FASHION IN FAIRS change. It has been 107 years since the opening of the Great Exhibition of the Works of Industry of all Nations, in London in 1851, and it is interesting to look back at that world's fair and compare it with the current Exposition in Brussels.

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There is little need to further describe the Brussels Fair other than to note that it generally represents an attempt by the exhibiting nations to display the social and cultural life of their people.

The Great Exhibition in 1851 was built around a different concept. Its emphasis was not on man and his relation to man, as at Brussels, but on the machine and its relation to man. In 1851 no one was ashamed of materialism. The machine was a blessing. True, the industrial revolution which had begun in the 18th century had brought serious disruptive influences, but a new day was ahead. In this socially tranquil and prosperous Victorian period, the machine was being directed. Man was in control. The future was bright with promise of machine-produced luxury for all people.

The Great Exhibition was famous for two reasons: it was the first truly world's fair, drawing visitors to London from all over the earth; and it was held in the "Crystal Palace." Even today the design of the Crystal Palace seems remarkable. It was 1848-ft long, 456-ft wide, and 108-ft high at the transept. Nearly 300,000 panes of glass were fit, vividly lighting the red, blue, yellow, and white interior. Exterior walls were white or stone, with blue trim. More than 6-million visitors thronged the Crystal Palace to see the 100,000 exhibits.

Exhibits were grouped according to categories: raw materials, machinery, manufactures, and fine arts. Fine arts were included in this predominantly industrial fair because it was assumed reproduction of art works and ornamentation of manufactured goods were functions of the industrial world.

The Iron Age

Mid-19th century Europe was not yet into the age of steel. The Bessemer process of making cheap steel would not come for five more years. Machinery, bridges, and other "manufactures" showed iron had usurped the place of wood as the prevalent building material. This substitution had become imperative as early as the 17th century, when Europe was plagued by a great timber famine resulting from years of deforestation.

There was steel on exhibit, but it was expensive steel made by the crucible process. Even then the world-renowned Krupp firm won recognition for its unusually fine steel. The judges confessed they had never seen such fineness and homogeneity of

grain in large steel castings. Besides the castings, Krupp sent finished steel items including cannon.

The presence of so many peaceful products alongside the cannon is evidence that Krupp concentrated then and later on machine tools and railway equipment although the firm was popularly (and erroneously) known in the 20th century as primarily an armament manufacturer.

Nonetheless, it was significant and prophetic that Krupp sent cannon and other heavy products while Austria, the nation which would see Krupp cannon under less agreeable circumstances in the Austro-Prussian War, submitted fine sheet iron for covering buttons. This "iron paper" won a highest award at the Exhibition. (In passing, 169 other exhibitors won the Exhibition's highest award — a bronze Council Medal struck by the Royal Mint.)

Of even greater interest for the future was some uranium oxide displayed by an English manufacturer. The uranium received little more than passing notice and that only because it made molten glass a "charming" color. Source of the metal was no secret: the Exhibition catalog mentioned that "uranium is procured from pitchblende, uranite, and other minerals from Cornwall and Bohemia."

The exhibits clearly demonstrated that the power of the age was steam. Steam engines displayed were used as prime movers, for sea and land transportation, and for farm mechanization. Many were highly ornamented in fussy Victorian, elegant classic, or even exotic Egyptian designs.

Marine steam engines attracted much interest because steamships were relatively new and uncommon compared to steam locomotives or general prime movers. Wrote Robert Ellis, editor of the Exhibition's *Official Catalogue:* "The great improver of the steam engine (James Watt) questioned the probable application of steam to ocean navigation; and it is remarkable to find these immense engines exclusively adapted to steam navigation proceeding from the works founded by James Watt himself." Ellis referred to big marine engines exhibited by James Watt and Company that produced 700 hp from four huge 52-in. diameter cylinders. The output was used to drive a screw propeller.

Paddle versus Propeller

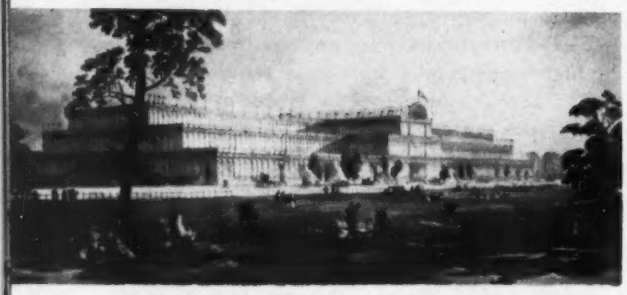
In 1851 the ship screw propeller was even more of an innovation than the steamship. While the paddle wheel had been common, the screw was just winning acceptance, bringing major power transmission design problems in its wake. Adapting the marine engine to the screw absorbed several exhibitors. The screw, revolving faster than the paddle wheel, required either direct drive from a high-speed engine or a gear train using the older and slower engines. Judging by the models on display, high speed and direct drive were preferred (even though the high-speed condensing engine required a high-speed vacuum pump). The problems with the screw were portents of things to come in technology: a horde of associated problems (such as improved gears and pumps) are concomitants of any technological progress.

In 1851 iron ships already plied the seaways. The Exhibition had numerous models of iron ships and commentators predicted huge iron vessels in the future (the 22,500-ton Great Eastern was conceived that year and launched in 1858). Naval authorities foresaw the iron merchantman, but noted the reluctance of the British admiralty to replace wooden hulls with iron. Iron ships were thought impossible to repair in the heat of battle, and the British Navy required that shipyards under government contract use wooden hulls so the ships might be appropriated in time of war.

While changes in marine engine and ship design excited the technically trained, laymen were absorbed by railway locomotive design. No dramatic mechanical or thermodynamic changes were being made in locomotives, but there was a burning question about the best over-all size for trains.

Actually, there were two questions of size: broad or narrow gage tracks and light or heavy locomo-

Raising first transept roof ribs. Crystal Palace was finished nine months after acquiring land.



Contemporary painting of the Crystal Palace. This view actually was obstructed by intervening trees.

tives. Both broad and narrow gage tracks were already in use (the Great Western was broad). One writer was not so much concerned with track gage as with locomotive weight. He believed the light engine would be best because more reading and writing could be done, since a small train would bump and jar less. Another expert argued a light engine could not keep to a precise schedule. One day there might be no passengers while the next there might be thousands. The solution was to wait until the train was loaded at each station, count the passengers, then attach the appropriate locomotive, light or heavy. Though favoring the heavy train, the expert admitted it was hard on tracks.

The Wonderful Atmospheric Engine

If the engine and gage problems appear quaint in retrospect, the "atmospheric engine" seems bizarre. Patented by the famous John Ericsson only five months before the Exhibition began, the engine commanded respectful consideration by foreigners and was positively eulogized by Americans (American comment on American exhibits revealed the pride of the young and ambitious nation). The engine's description in the *Official Catalogue* made it seem little short of miraculous:

"While in the steam engine the caloric is constantly wasted by being carried off into the atmosphere, in the improved engine the caloric is employed over and over again, enabling me to dispense with the employment of combustibles, excepting for the purposes of restoring heat lost by the expansion of the acting medium, and that lost by radiation also, and for the purpose of making good the small deficiency unavoidable in the transfer of the caloric."

The atmospheric engine enjoyed brief fame. By 1876 it was in decline. Instead of rivaling the steam engine, it was restricted to small jobs requiring under 5 horsepower.

Much more significant than the atmospheric engine was the hydraulic turbine exhibited at the Crystal Palace. Until the late 19th century hydraulic power and the water wheel were virtually synonymous, but pioneers had developed and installed turbines during the century, particularly in France.

Because of the subtlety of the turbine principle, it was infrequently appreciated by exhibition writers. One described the turbine as nothing more than an efficient water wheel. But it certainly was efficient. Claims of turbine efficiency ran as high as 75 percent in 1851 — 25 percent higher than the best water wheel.

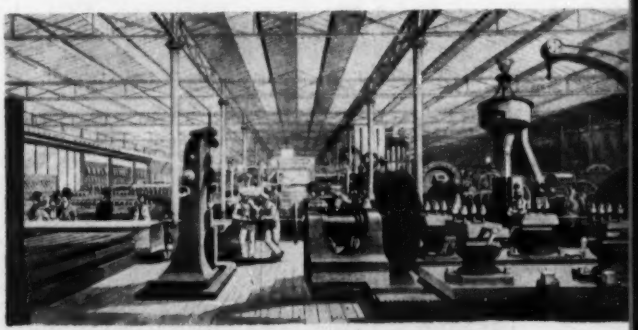
Electrical Equipment

Though the Victorians failed to appreciate the turbine, their lack of discernment here was slight compared with their utter incapacity to foresee the development of electricity. Electric devices were in the class of philosophical or scientific instruments, and science and scientists did not contribute much to the "practical" arts.

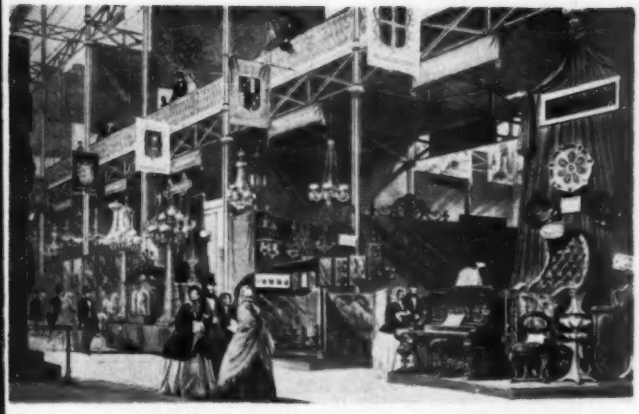
The only application of electricity thought practical was the telegraph, which had been chattering along since the 1830s. Why other applications of the force moving a telegraph sounder was not appreciated is difficult to understand. One explanation might be the ingrained acceptance of the battery as the only feasible source of power, even though generators were exhibited. Experts cited figures showing how much more costly battery power was than steam. No costs of generator power were mentioned. Few envisaged driving an electromagnetic machine (motor) with a magneto-electric machine (generator).

Motors exhibited at the Crystal Palace were powered by batteries. Some motors had pistons pulled to and fro by electromagnets, thereby showing a preoccupation with reciprocating principle of the steam engine. Other motors, however, rotated.

Essentials for efficient electricity production were present in 1851 but were not organized or related. For example, wire was insulated by rubber;



Machinery in motion attracted much interest. Steam was supplied by a specially built boiler house.



Hardware section at Exhibition showed everything from pins to pianos—"necessities and conveniences."

both alternating and direct current were produced by generators (albeit a wildly fluctuating current); steam engines were available to turn generators; and powerful electromagnets were on hand.

An exception was an exhibit by William T. Henley. He displayed (among the philosophical instruments) a treadle-operated generator, supplying electricity to drive an elementary servo motor which moved its armature to indicate telegraph messages. Henley revealed the germ of large-scale economical power generation, but his apparatus received no unusual comment. One man of technological interests lightly discounted Henley's combination, while another had great expectations for an electric machine driven by rubber bands.

Contemporaries recognized a need for a smaller and simpler power plant than the steam engine. Charles Babbage, an outstanding British mathematician, designer of early calculators, and a publicist, said industry required a power source always ready for use, with a small horsepower rating suitable for the shop. Babbage thought hydraulic machines driven by pressure from public mains the answer.

Despite having the essential components, over a quarter-century passed before a commercial electric power system appeared. In the 1880s Sprague motors were used with Edison central station systems in the U.S.

The Marvelous Machines

Along with steam and iron, machines dominated the Exhibition. Wrote one commentator: "Highly deserving of notice, the perfection of their operation exceed that attainable in most instances by the highest exercise of human skill." The full impact of mechanization had not been felt then. Machines predominating at the Exhibition were for working metal (machine tools) or raw cotton (textile machinery); by comparison other machines were few. Even crude home appliances were nonexistent.

Shown the textile machinery of 1851, today's cotton manufacturer would feel among familiar surroundings; today's machine shop operator would recognize many things in an 1851 machine shop. The only readily distinguishable features of the 1851 textile machines and machine tools would be the belt drives and the large heavy iron members. Basic design of planers, drills, borers, slotters, riveters, shears, and punches has changed little.

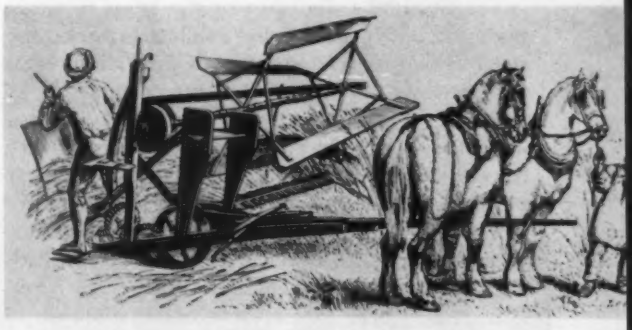
In a nation where agriculture was still the major industry, farm machinery was not neglected. The trend even then was toward mechanization, as one commentator wrote:

"In no other country, of late years, has agriculture been rendered so largely an object of experiment as in the United Kingdom, and in none other do the requisite amount of capital, and the supply of means for such experiments, proportionately to the area of the soil occupied, exist. Perhaps it may be added that in no other country does there exist the same absolute necessity for the complete development of the productive capabilities of the soil. The application of philosophy to this art is recent, but promises favorable results."

Many steam engines shown at the Crystal Palace for farm use developed 2 to 6 horsepower and were hauled by horses. They were of simple, sturdy construction for fast easy repair by the farmer. One model was self-propelled by revolving plows attached to the steam engine. This "locomotive steam plow," constructed by James Usher of Edinburgh, was a forerunner of the modern tractor.

Stationary and portable steam engines powered equipment to thresh, dress, grind, and cut agricultural produce; pump water; saw timber; and do "other stationary labour in the farm and estate."

Despite a preponderance of British agricultural machinery, Cyrus Hall McCormick's reaper was the most popular agricultural exhibit. British reap-



Agricultural favorite was the McCormick reaper, even then acclaimed as a revolutionary tool.

ing machines were also on display, but in operating tests, McCormick's reaper proved superior.

Canned Goods

Of equally great agricultural significance were some pioneer canned foods. Messrs. Donkin, Hall, and Gamble introduced canning to England around 1810, based on a process by Francois Appert of France. Arctic explorer Sir John Ross dramatized canned products when, wandering around Canada in 1833, he discovered some perfectly preserved canned boiled mutton left over by an 1824 expedition. Besides this epoch-making find, Sir John also happened on the magnetic north pole. The canning industry trumpeted Sir John's important discovery (the mutton) at their Exhibition displays.

There was an astounding variety of canned foods on display: beef, veal, fresh milk, carrots, peas, mushrooms, beetroot, salmon, oysters, turnips, and a number of soups. Cans were soldered shut after all possible air had been evacuated, and each can was tested in 100-degree Fahrenheit heat which would burst any cans of putrified food.

Canned food, however, did not achieve the Exhibition renown that Gail Borden got for his Borden Meat Biscuit. As it turned out, Borden's biscuits spoiled relatively rapidly contrary to guarantees. Later, his condensed milk brought him lasting fame.

Chemical substances, including canned foods, were grouped in three divisions according to whether they were used in manufacturing, by scientific chemists, or in medicine and pharmacy. The industrial chemist then did not capture the popular imagination as did the machinist and civil engineer. Even today economic historians overlook developments in industrial chemistry that were an integral part of the industrial revolution.

Prominent among the chemical products were synthetic soda and sulfuric acid, both essential to the "chemical revolution" of the 18th and 19th centuries. Textile manufacturers needed these chemicals for dyeing, bleaching, and other steps in the textile complex.

The Exhibition also showed the latest in transportation. There were many exhibits featuring the remarkable progress of railroads and steam locomotives since the beginning of the century.

Besides the steam railways the Victorian had a magnificent selection of animal-drawn carriages for traveling. Some names of carriage-types are familiar today — landau, phaeton, cabriolet. Others are fascinating — dress vis-a-vis, barouche, britzska, fourgon, dormouse, clarence, dog cart, invalid bath chair, fly, and hearse. The 1851 carriage-buyer probably mulled over the advantages of a dormouse versus a fly much as today's car-buyer compares a station wagon and a sedan.

Judging by the Exhibition, civil engineers concerned themselves primarily with lighthouses, bridges, docks, harbors, canals, gas works, sewage disposal, residential heating, and public and private dwellings. Bridges dominated the Exhibition. A view of the great suspension bridge at Kiev, designed by Charles Vignolles for the emperor of Russia, indicated the outstanding work done by English bridge-builders then.

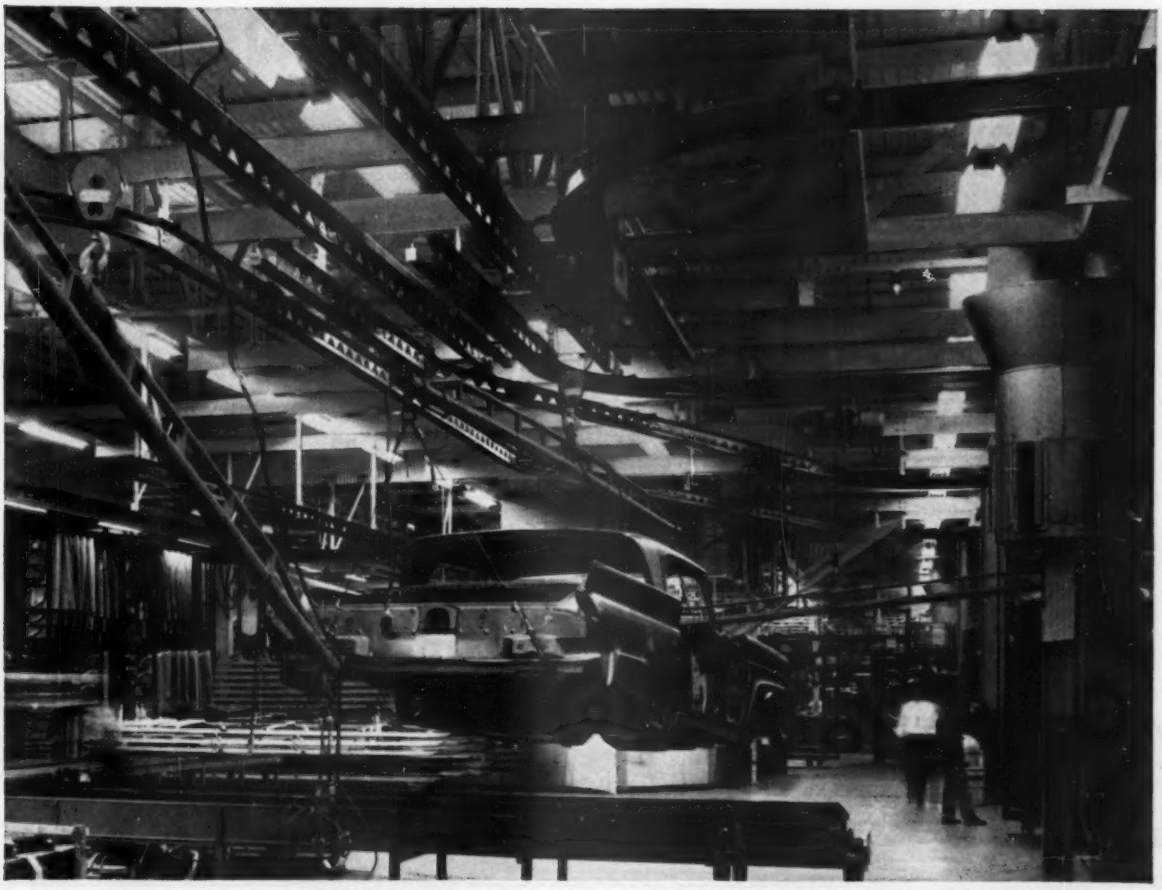
For the Great Exhibition, bridges were classified by materials (timber, cast iron, wrought iron, brick, and stone) and design (lifting, rolling, suspension, floating, and turning). Combinations of materials were used: for example, cast iron for compression members and wrought iron for those in tension. (Steel was still too expensive to be used alone in major construction jobs.) This selective use of materials indicates knowledge of stress analysis, as do the suspension bridge models at the Exhibition. Among the models of bridges and buildings was a suggestion for ridding cities of smoke. Sewers would carry off smoke from the many fireplaces.

The Class and Mass Markets

Manufactured consumer items were produced for the well-to-do, who could spend extra for decorated utilitarian objects or luxury items to embellish themselves or their homes. A large percentage of such heavily ornamented goods was made by the textile and home-furnishings industries. Even though machine-made decorations were inexpensive compared to creations of the craftsman or artist, the lavish decoration added costs that could be ill-afforded by the poor. Huge kitchen ranges adorned with cupids might do in a well-staffed kitchen, but they would not serve in the tenement flat of the worker or the small cottage of the agricultural laborer.

But this failure to meet the needs of a majority of the people was not selfish disregard by the capitalists. Exhibition literature shows that men of station and influence predicted the ever-increasing abundance of goods turned out by the machine would raise the living standards of all. Many manufacturers concentrated on the middle classes because here was a rich market that had not been exploited. They realized that a mass market meant massive profits.

Steam engine and water turbine, telegraph and electric machine, iron and steel, paddle wheel and screw, wooden hull and iron bottom . . . as Prince Albert said, the Exhibition gave "a living picture of the point of development at which mankind had arrived and a starting point from which to direct future exertions." His words typified an age of industrial innocence which is unlikely to return. The current Brussels Exposition lacks this wide-eyed hope for the future. ▲▲



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7 Type "E" — For spacing and individually insulating wires as they emerge from conduit. Molded canvas Bakelite covers have high dielectric and mechanical strength. Sizes: ½" to 6".

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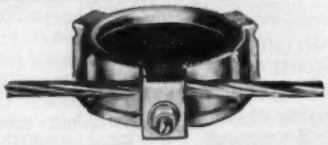

8 Type "GB" — Corrosion-resistant bronze. Ideal for grounding banks of conduit where metallic-protected cable is used. Sizes: ½" to 6".

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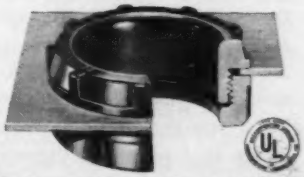

12 Type "ABB" — Combination of Type "A" and "BB" bushings to insulate cables passing through metal boxes or troughs. Sizes: ½" to 6".

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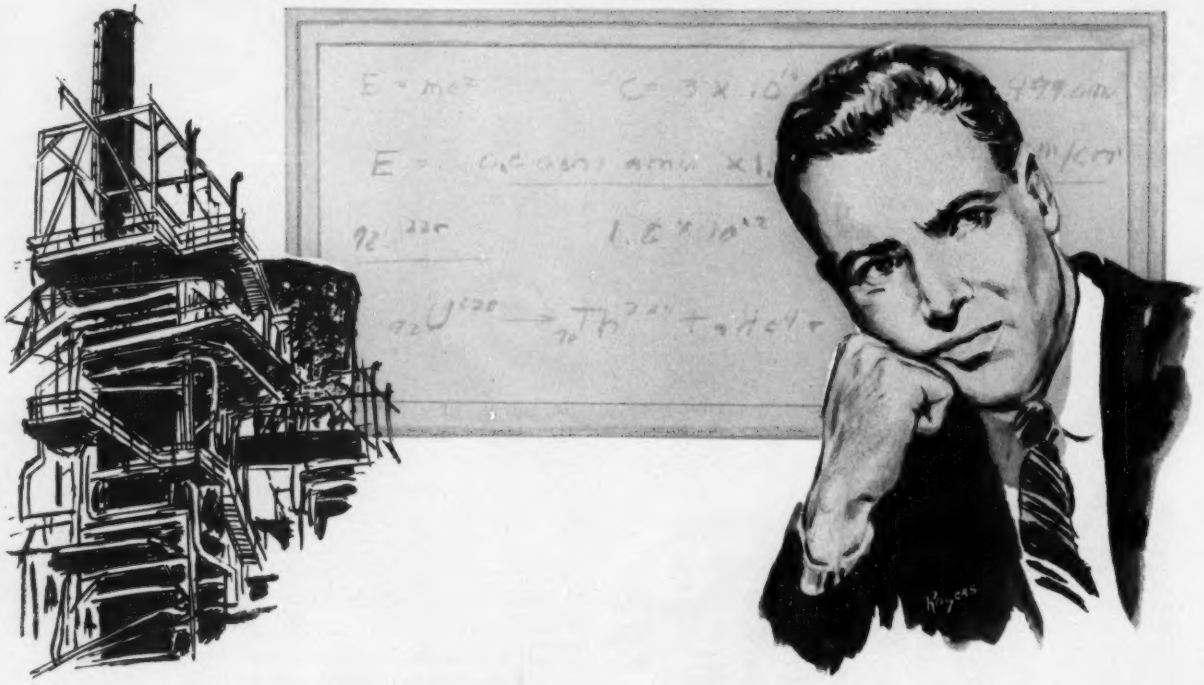


Training a Nuclear Engineering Staff

DR. S. BARON, Burns and Roe, Inc.

ALL OF OUR major industries will be influenced to some extent by nuclear projects now in progress, and more engineering knowledge will be required as new fields are explored. Consulting firms who have had the vision to plan, staff, and train to meet the new challenges have established a strong foothold in such applications of atomic energy as power generation and ore processing. New organizations attempting to enter these areas of nuclear activity are sure to find the going rough, but there are many new, unexplored, or only partially developed facets. These are certain to be rewarding to any organization that plans intelligently for the nuclear age. However, while it is not too late to start, time is fast running out.

CE exclusive

Unparalleled Opportunities

The unprecedented rapidity of developments in atomic energy and its related field of radiation application has presented unique opportunities to many engineering organizations who prepared in advance to meet the problems they knew would be created. The extent of each company's involvement has been greatly influenced by its desire to participate and its degree of preparedness.

The power generating field probably will be the first industry greatly affected by this new source of energy. There is also as great a potential involvement for the chemical and metallurgical industries in the production of exotic metals, the fabrication of fuel elements, the preparation of special fluids and gases, and the reprocessing of depleted fuels.

Transportation, Too

Water, land, and air transportation will also be affected. Instrumentation specialists already are engaged in the design and production of extremely sensitive and highly reliable instruments involving nuclear applications. Laboratories throughout the world are being designed to discover new uses for radioactive materials. There is also a search for basic knowledge of radiation technology to apply to agriculture, medicine, chemistry, and machines.

Since the nuclear field is new and expanding so rapidly, it is difficult to predict the future role of

consulting engineering organizations. In early developments the equipment and chemical manufacturers were the first participants. Large and costly programs were common, and the necessary capital, facilities, and pool of scientific personnel were readily available in these organizations. At that time consulting engineers were employed by the government or industry only to work on conventional phases, such as the structural design of supporting nonnuclear facilities. This gave the manufacturers an initial advantage. They gained knowledge and experience which has kept them in the forefront of the nuclear field.

Active AEC Encouragement

However from the beginning, the United States Atomic Energy Commission has very actively and successfully encouraged engineering organizations to participate, assigning them increasingly greater responsibility. Now there are many such organizations, fully staffed with experienced personnel. Incidentally, many manufacturers prefer to be relieved of the layout and design of nuclear installations so that they can concentrate on equipment design and process development. But this opportunity can be grasped only if consulting engineers are fully prepared to accept the responsibility.

Once an engineering organization decides that it would be wise for the firm's future to work in the nuclear field, it must decide on a plan of development. A special staff must be organized. There must be an educational program and an integrated sales effort. Development of as much experience as possible must be crowded into the shortest time. The extent of any of these efforts depends primarily on the size of the company and its anticipated extent of participation in the nuclear field.

One Man or a Division

The large engineering organization active in the power, propulsion, and chemical fields conceivably could plan on setting up a fully staffed and experienced nuclear division. A small engineering firm with limited or specialized experience might consider the education of one or two of its staff in nuclear technology. In this way, with a minimum investment of time, money, and personnel, it could keep abreast of radiation application techniques in special material development. Between these two extremes would be an engineering organization of some 100 or 200 people with modest general experience. This type organization should have some trained and experienced personnel grouped as an operational team.

There are many ways for an engineering organization to educate its personnel in the nuclear field. Most universities have courses in nuclear technology ranging in scope from a survey type of course to laboratory experiments in radio chemistry and nuclear physics. Working engineers often are able to attend evening courses. Some universities now are offering degrees in nuclear engineering. For example, MIT recently created a nuclear engineering department, and no doubt many other universities will follow this lead.

Technical Seminars

Some of the various technical societies have conducted survey-type courses in nuclear engineering for many years. Similarly, management associations have conducted seminars on atomic energy for the benefit of supervisory personnel. For the convenience of their employees, some consulting firms arrange for experienced nuclear engineers and scientists to give lectures during or after office hours. These lectures vary from general reviews to detailed analyses of the theory and mathematical considerations of heat transfer in nuclear reactors.

Through its national laboratories, the AEC offers intensive courses in laboratory programs in nuclear technology. For many years now, Oak Ridge and Argonne National Laboratories have offered full-time courses for periods ranging from nine months to a year on all phases of nuclear technology including physics, chemistry, metallurgy, instrumentation, and chemical and nuclear engineering. Actual laboratory experiments in various fields often supplement these lectures. For special training efforts, arrangements can be made to permit an engineering organization to supply engineers to work with the laboratory staffs for various periods.

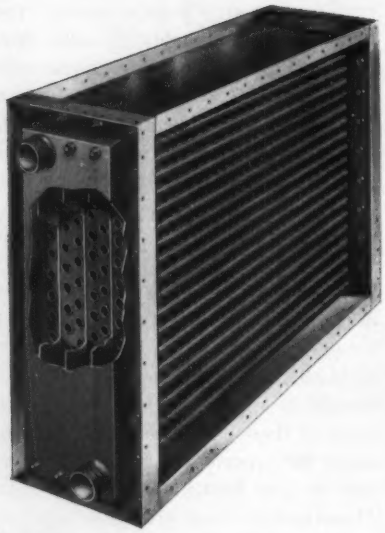
Continuity Is a Must

The extent of any participation is governed by size, interest, and expediency, but no matter how ambitious a training program may be, unless it is a continuous one it will not be of any permanent value. We all know how difficult it is to retain abstract knowledge unless it is applied regularly. This knowledge can grow only by working on nuclear projects or by continuously studying the problems in the field. Any money spent on training is largely wasted if this continuity is not maintained.

In preparing for the nuclear age we, at Burns and Roe, have used all the methods mentioned. In the very early stage, engineers who were interested in this new field attended courses at universities and technical colleges. Then when management decided to pursue an active program of nuclear education, the company proceeded along two lines.

Engineer Selection

At first, each of the various engineering departments selected engineers with good technical edu-



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cation, experience, and a demonstrated capacity to learn. These engineers attended lectures given at our offices by leading nuclear engineers. These sessions were held weekly, lasted for nine months, and covered all phases of nuclear technology. The subject matter was organized to present a continuous development from basic theory to practical applications in nucleonics.

Additional Training

For the second step, several engineers with strong academic training and outstanding performance on company projects were selected for comprehensive training at one of the national laboratories. Upon their return, these people were assigned full time to the company's nuclear activities. With this corps of trained personnel, the company proceeded to work on nuclear projects while continuing educational work at company expense.

Hire Outsiders?

There is always the question as to whether it might be cheaper and quicker to employ persons already experienced in the field rather than to train existing personnel. The outside approach is good and may be necessary if there is an immediate and urgent need for trained men, but there are drawbacks. New personnel, although experienced, have yet to prove their abilities to company management. In addition, new personnel are not familiar with the company's engineering practices and organizational procedural methods.

We decided that a blend of newly employed nuclear engineers and experienced, trained company personnel would produce the most effective operating group. Therefore, as our activities increased in the nuclear field, we supplemented our staff engineers by hiring designers and engineers who already possessed nuclear experience.

Organizational Questions

Any company's approach to the problem of organizing its nuclear activities must be governed by more than size, interest, and expediency. Consideration must be given to the inherent organizational philosophy that each company has found suitable for its general activities. Small organizations usually set up their nuclear engineering projects under the supervision of the person in charge of one of their regular engineering departments. A large organization planning on major activity in the nuclear field might be wiser to create a separate nuclear department. With either arrangement it must be remembered that while nuclear engineering is a specialized activity, it embraces all of the classic engineering sciences, plus the additional ingredient of nuclear physics. Therefore, to function effective-

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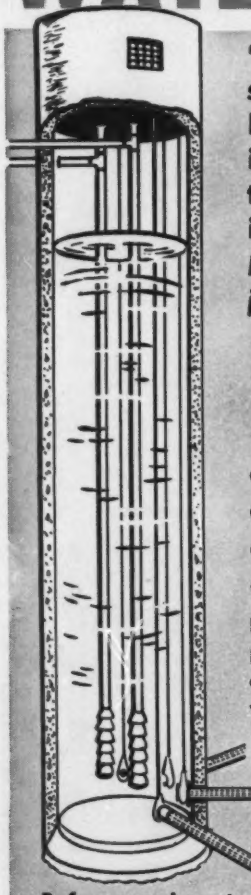

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ly, a nuclear department should be staffed with engineers and physicists also experienced in the conventional fields of mechanical, electrical, structural, chemical, and physical sciences.

Limited Responsibilities

Even though Burns and Roe's nuclear personnel also are experienced in conventional engineering and physics, their activities are limited to the design of systems concerned with the handling or processing of radiation or radioactivity. Our other engineering departments still retain responsibility for conventional facilities associated with nuclear installations. In this way, our new department can function as a highly specialized group without affecting our established engineering practices. However, the experience in conventional engineering is important because it permits the group to translate nuclear designs into conventional engineering language.

Nuclear Physicists Not Essential

Those engineering organizations entering the atomic energy field should not feel that it is essential to add nuclear physicists to its staff. What is important is that their engineers have thorough training in nuclear physics so that physics problems can be solved by engineering methods. We realize that many physicists have adapted their knowledge to practical engineering applications. These people are of great value to any engineering organization. However, there is little to be gained by staffing a nuclear department with nuclear physicists whose experience is limited to basic research and theory.

The time and money a company invests in the training and organizing of a nuclear staff is predicated on their expectation of a profitable return. This means that once an organization launches into the nuclear field, there must be a continuous effort to employ people on reimbursable nuclear projects. Like any business venture, there is no guarantee of success, but with the increasing uses of atomic energy, long-term profit should be assured. For the immediate future, engineering organizations must be prepared for only a gradual return on their investment, which could be sizable.

Military Projects

The military applications of atomic energy have added to the normal problems of a consulting firm gaining a foothold in a new field. As a result of the urgency of time and the magnitude of many of these projects, companies have been required to organize large staffs of experienced personnel. As these projects are completed, there may be insufficient nonmilitary activities to keep the staff gainfully employed. Large and diverse engineering organizations have a better chance to absorb this

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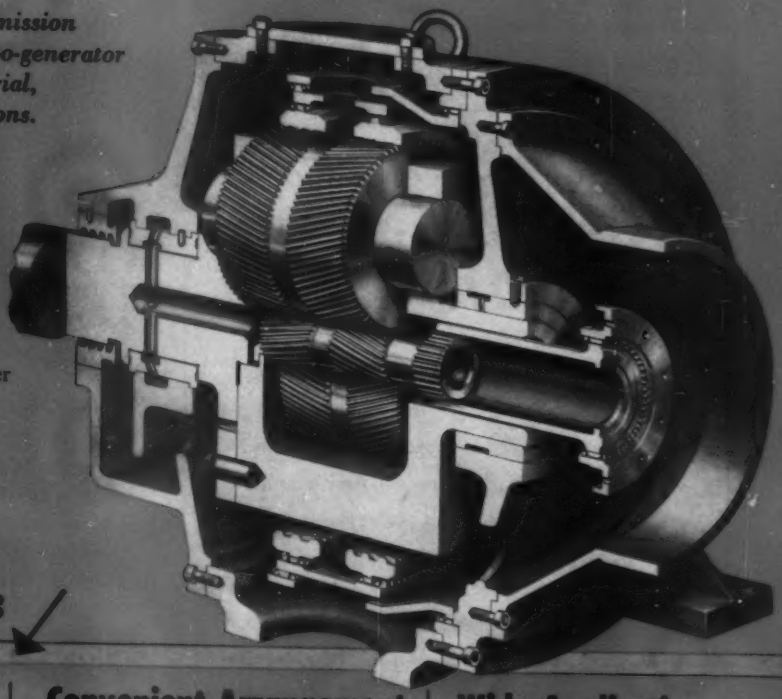

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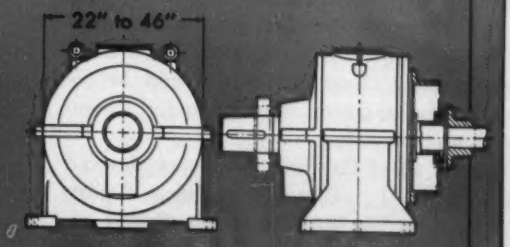

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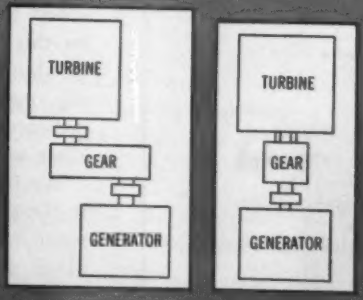

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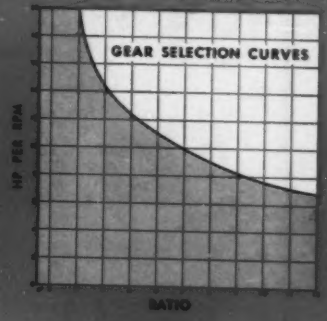

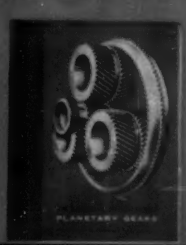

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excess manpower than smaller companies who have increased their staffs specifically for large efforts and then find later that they must release many of their designers and engineers. This makes it vitally important to develop a flexibility and versatility that will permit the firm to ride over these peaks and valleys without losing position in the industry. At Burns and Roe we have been able to do this because our nuclear personnel are equally experienced in our many other engineering activities.

Familiarity with AEC

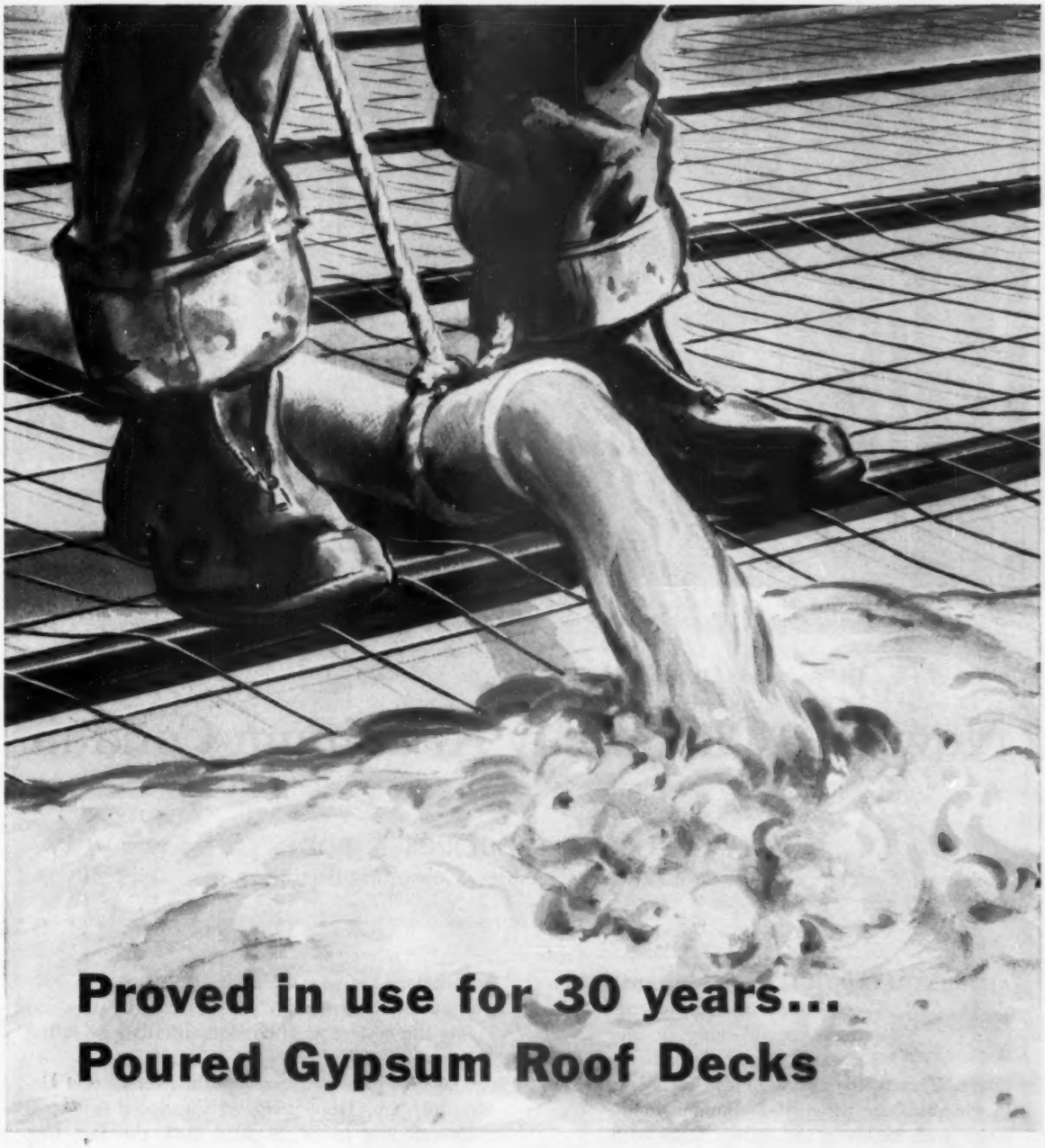
Because the AEC is the fountainhead of all the major activities in the nuclear field, it is necessary to become familiar with its organization and operations. This involves not only the administrative aspects but also technical developments. The AEC has published extensive material of a technical as well as administrative nature. This information is unclassified and available to anyone. A great deal of advanced work carried on by the AEC also is unclassified. Certain areas of technical development which bear on military applications are classified. However, access permits are available to properly cleared people for much of this material.

In addition, every effort should be made to let the AEC know about your company's organization, experience, and interest in the nuclear field. Then the various AEC offices will keep you informed of new projects. Many of these projects will be too large for a new organization with limited experience. However, industrial organizations acting as prime contractors to the AEC often award smaller packages of work on a subcontract basis. Many other government agencies issue contracts for the design of nuclear facilities in their areas of responsibility. There also are privately financed operations in the atomic energy field.

Communications Problems

Communicating with the manifold governmental agencies and private industries can be a difficult and time-consuming effort. Large organizations probably will feel the need to have at least one experienced nuclear engineer spending most of his time on this type of work. Smaller companies may be able to handle these contacts within their existing organizations. These activities should be coordinated by the engineer responsible for all nuclear work and projects.

We feel that all of the time and money devoted to the planning and staffing of our nuclear department has been an investment that already has enabled us to gain valuable knowledge and experience. We feel that our current involvement in major nuclear projects justifies our long and thorough period of planning, staffing, and education. ▲▲



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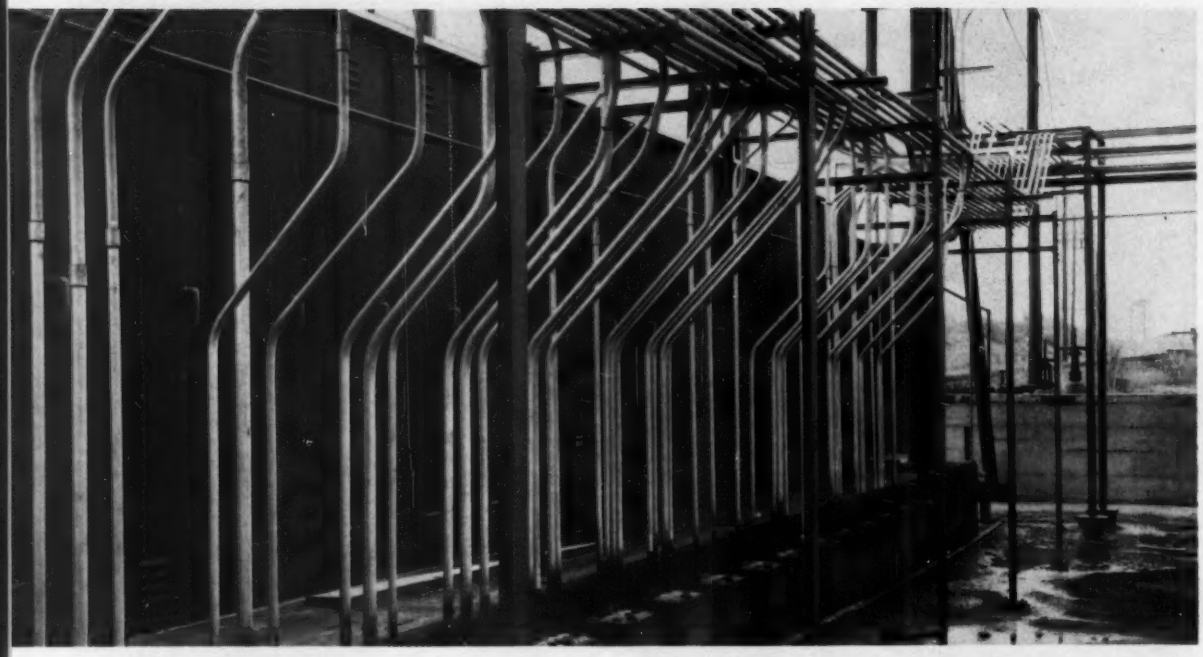


Use of aluminum conduit in industrial substations is illustrated by this photo of a chemical plant installation.

Now We Can Specify Aluminum Conduit

SAM STARR and FREDERICK A. RODE
The Firm of Edward E. Ashley, Consulting Engineers

ALUMINUM CONDUIT now is demonstrably more economical than steel conduit for many installations in the larger sizes — 1½" nominal diameter and above. This is the result of the recent reduction in the purchase price of aluminum conduit combined with its lower installation labor costs.

The price reduction, which went into effect January 20, 1958, abruptly reduced the basic price to electrical contractors of aluminum conduit from an average of close to 40 percent above steel, to a uniform level only 20 percent above steel throughout the range of common conduit sizes. Only three weeks earlier, a new wage agreement between the electrical contractors and the electricians union (The International Brotherhood of Electrical Workers) had raised labor costs about 20 percent above the previous level. Estimates based on these new figures indicate that the cost of aluminum conduit installations are now within 5 percent of steel conduit installations in the ½", ¾", 1", and 1¼" sizes and below the cost of steel conduit installations in the larger sizes.

This new price situation and the over-all cost picture, including labor costs, are illustrated in Fig. 1.

Despite the lower installed cost, the fact that aluminum conduit, size for size, has been and still is more expensive to buy than steel conduit will continue to penalize the use of aluminum conduit to a degree greater than the actual price difference would justify. This results from the fact that the price difference is felt by the contractor as an immediate out-of-pocket expense, while subsequent economies in handling and installation are harder to evaluate.

In most conduit installations, particularly with steel conduit, labor costs will be considerably greater than the purchase price. Consequently,

labor costs should be considered carefully. The cost of installation labor is less for aluminum conduit principally because of its lighter weight. Size for size, a piece of steel conduit is nearly three times as heavy as a similar piece of aluminum conduit. In addition to permitting more rapid installation, the use of aluminum conduit reduces worker fatigue. Also cost economies for aluminum conduit are realized in storage (no rusting of threads occurs) and in cutting, threading, and bending operations – which, if properly done, are performed with less time and effort.

This labor cost savings has not been found significant in the installation of the smaller conduit sizes (such as ¾" or 1") but becomes appreciable as conduit size increases.

Comparative Conduit Weights

A standard 10-ft length of ¾" aluminum conduit weighs about 3¾ pounds while its steel equivalent weighs about 10½ pounds. Obviously, no great physical difficulty should be encountered in installing either. But ¾" steel conduit usually is delivered in groups of five, weighing about 53 pounds, and ¾" aluminum conduit comes bound in groups of ten, weighing about 37 pounds. Therefore a handling cost savings can be expected for aluminum conduit even in the smaller sizes.

In the larger sizes, such as the 3½" size, which weighs 29 pounds in aluminum and 83 pounds in steel, appreciable labor savings can be expected in handling and installing aluminum conduit, especially under hazardous or difficult conditions.

Comparative Feeder Weights and Supports

The weight of a steel conduit in all sizes (½"-4") exceeds the weight of the copper wires within it by an appreciable amount in the larger sizes and by several times in the smaller sizes. This relationship is shown quite clearly in Fig. 2 for two representative sizes, ¾" and 3½", carrying 4-wire feeders. The weight relationship also is shown for aluminum conduit.

For the smaller size, a feeder consisting of copper wires in aluminum conduit weighs less than half as much as a copper wire-steel conduit feeder. In the larger size, the copper cable-aluminum conduit feeder weighs about two-thirds as much as the copper cable-steel conduit feeder.

The relatively large weight advantage has very little influence on the number of supports required for small feeders used for branch circuits. However, for large cable-conduit feeders in sizable groups or banks, the number of required supports is likely to be proportional to the weight. Here, very definite labor savings will accrue to an aluminum conduit installation. This will be particularly true where supports must be installed in existing masonry with laborious, hand-driven star drills. Fig. 3 indicates the comparative number of

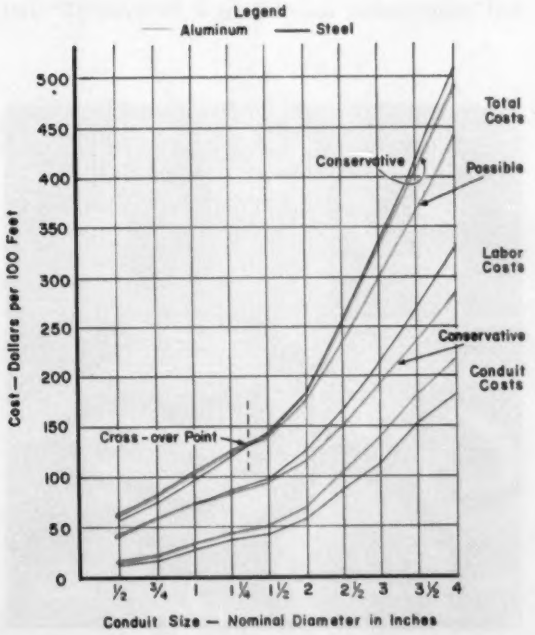


Fig. 1 – Material and labor costs for steel and aluminum conduit installations (February 1958).

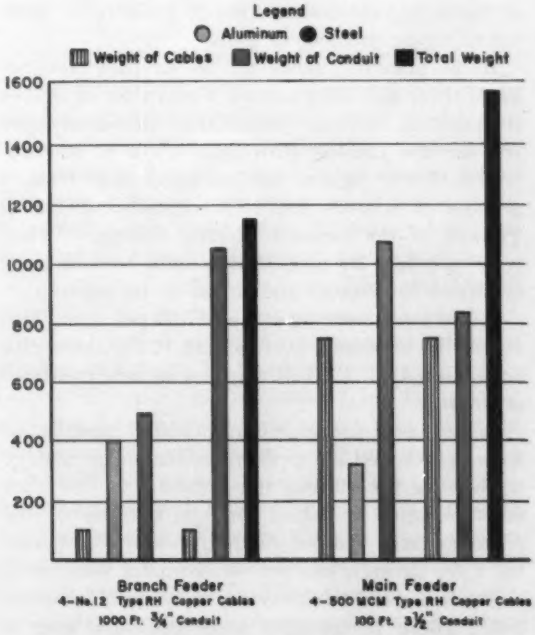


Fig. 2 – Comparative weights of branch and main feeders using steel and aluminum conduit.

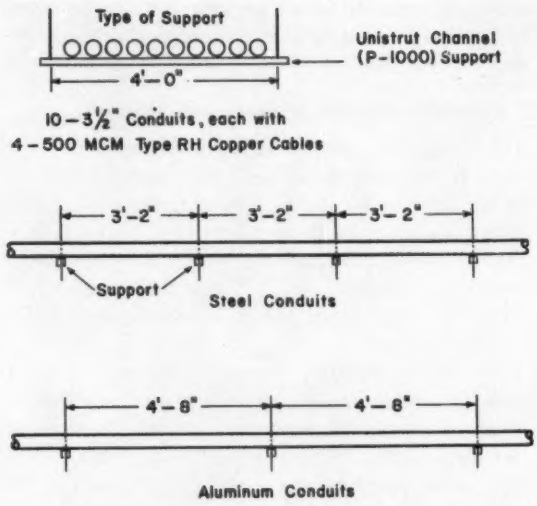


Fig. 3 – Support requirements of large size steel and aluminum conduit for same allowable deflection.

supports required for aluminum and steel conduits for a typical 10-conduit array.

Determining Installation Labor Costs

While most electrical contractors are convinced that labor savings are possible with aluminum conduit, considerable difficulty is encountered in attempting to measure this advantage. Most electrical contractors are still unfamiliar with aluminum conduit, while a few others have had difficulty in cutting or threading aluminum conduit because of their use of wrong methods or tools.

It is possible, however, to prepare reliable installation cost comparisons. First, a set of figures representing average installation man-hours per 100 feet for conduit sizes from ½" to 4" was obtained. These figures are averaged data from a number of sources and were compiled by H. J. Finison, of the General Electric Company. They were checked by consultation with several large electrical contractors and found to be accurate.

Labor costs were figured at $7.00 per hour. This rate is the estimated average cost to the contractor since January 1, 1958. It does not include overhead or profit.

Labor costs for aluminum conduit installation were determined by applying estimated percentage savings for the various size conduits to the labor costs obtained for steel conduit. Because of the present scarcity of information available concerning these savings, two sets of estimates were used.

The first set of labor savings is labeled "conservative." These percentages were obtained from a large New York City contractor who has installed a considerable amount of aluminum conduit. He estimated that labor savings increase from 5 percent on ½" conduit to 14 percent on 4" conduit.

The second set of labor savings percentages is referred to as "possible" and ranges from 5 percent for 1¼" conduit to 30 percent for 4" conduit. These figures were derived from our own poll of several hundred leading electrical contractors throughout the United States. It is felt that these are savings that can be approached and obtained by experienced labor with aluminum conduit.

In the poll most contractors who had installed aluminum conduit stated that they had realized appreciable labor savings. The average estimated saving was 10-15 percent, but there were some that ranged from 20 to 40 percent.

Widely varying and even contradictory estimates are not surprising when dealing with a relatively new product. Many unfortunate reactions result from unthinking use of old methods on a new material. It is then natural for the installer to condemn the new product, instead of blaming himself for his lack of knowledge of the proper techniques for working with the new material.

Conclusions From Comparative Cost Curves

Three sets of curves are plotted on Fig. 1:

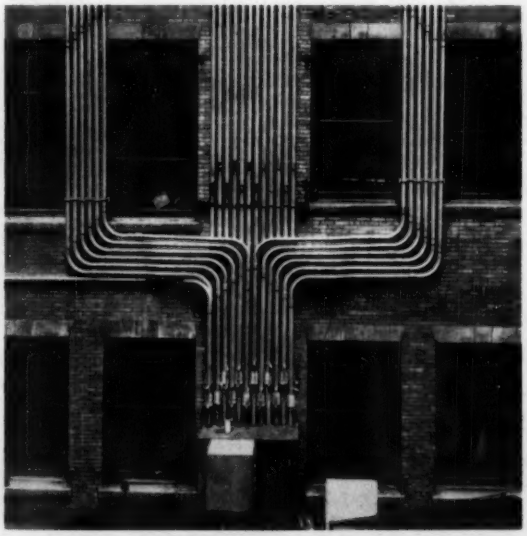
¶ Conduit purchase costs

¶ Conduit labor installation costs

¶ Total costs – the sum of the previous two costs

A number of important conclusions can be drawn from these curves.

The crossover point for total costs of aluminum and steel conduit installations is between 1¼" and



Light weight of aluminum conduit is well suited to difficult installations on existing buildings.

1½" conduit. Aluminum conduit installations using 1½" and larger sizes are less expensive in over-all cost; steel conduit installations are less expensive below this size. This holds true for both the "conservative" and "possible" labor savings curves.

Total conduit installation costs in either aluminum and steel are quite close together, even in the branch circuit sizes (½" to 1¼") where no labor savings were assumed. Actually, many contractors feel that a labor saving is possible even in these sizes.

Labor costs now constitute a higher percentage than ever of a conduit installation. In the small sizes, 1" and below, labor constitutes about 70 percent of the total cost of a steel conduit installation and well over 60 percent in the larger sizes. This means that any rise in labor wage rates will make the use of aluminum even more favorable. Difficult installation conditions, requiring more man-hours than normal, also make the use of aluminum conduit more attractive.

Forecasts and Recommendations

Those conclusions lead to several forecasts and recommendations:

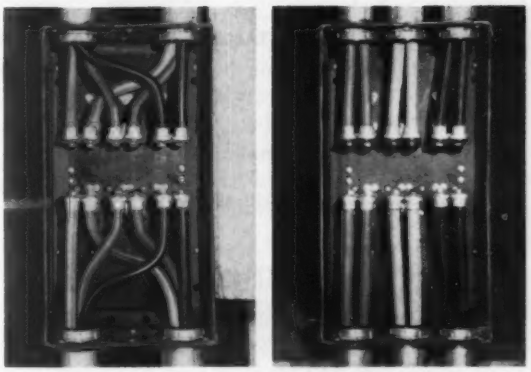
¶ Aluminum conduit will be more economical in difficult installations such as alterations and high risers on building exteriors.

¶ Aluminum conduit will be more economical in the main riser systems of large structures where many large size conduits are used.

¶ Large organizations that maintain considerable maintenance staffs and stock large quantities of materials, such as conduit, now should consider standardizing on aluminum conduit for the 1½" sizes and above, for cost economies can be added to other advantages such as corrosion resistance, handling ease, fatigue reduction, and decreased maintenance.

¶ Because of the small total cost differences in the smaller conduit sizes, all-aluminum conduit installations now may be installed in buildings other than those owned by the aluminum companies.

¶ Consulting engineers should modify their specifications to permit the use of aluminum conduit. Many specifications bar the use of aluminum conduit by specifying only steel. These specifications should be revised to permit aluminum to compete.



Circuit breaker enclosure and terminal extensions using steel conduit (left) and aluminum conduit.

Aluminum conduit embedded in concrete at outdoor substation since 1939 has not corroded.

Existing Aluminum Conduit Installations

There are, at this time, a surprising number of aluminum conduit installations in the United States. A large proportion, understandably enough, are in plants and projects owned by aluminum manufacturers. A typical example is the 76 miles of aluminum conduit, from ½" to 5" size, which was installed in Alcoa's Davenport, Iowa plant.

The Alcoa Building, built in 1952, also has an all-aluminum conduit installation. A recent inspection showed no discernible deterioration of conduit or fittings. No maintenance has been necessary. The electrical contractor for the project said that labor savings were especially marked for installation of conduit sizes of 1½" and up.

Actually, there are existing aluminum conduit installations which go back as far as 1925. These older installations generally were dictated by unusual or difficult service conditions for which standard steel conduit was not suitable. These include sewage disposal plants, chemical plants, and factories where resistance to strongly corrosive atmosphere and splattering is required. Frequent applications were

TABLE 1 — COMPARATIVE COSTS OF A CONDUIT INSTALLATION
ALUMINUM CONDUIT VS. STEEL CONDUIT

	Aluminum	*Steel*
1. Total installation cost	$12150.00	$13500.00
	(90%)	(100%)
2. Conduit cost per 100 feet	136.00	91.20
	(153%)	(100%)
3. Total length of 2½" conduit	2700 feet	2700 feet
4. Total purchase cost of conduit	3700.00	2460.00
5. Profit — 10%	1100.00	1230.00
6. Overhead — 15%	1440.00	1600.00
7. Total labor cost (by subtraction)	5910.00	8210.00
8. Total labor savings	28%	
9. Estimated steel conduit labor @ $2.00 per foot		5400.00
10. Scaffold labor and miscellaneous costs (by subtracting 9 from 7)	2810.00	2810.00
11. Estimated aluminum conduit labor cost (by subtracting 10 from 7)	3100.00	
12. Conduit labor savings	43%	
13. Total job cost savings	10%	

made in outdoor and indoor substations where aluminum's weather resistant and nonmagnetic properties are important. And aluminum conduit long has been used in unusual and difficult locations inaccessible to ready maintenance.

Existing Outdoor Installation of Aluminum Conduit

An interesting and instructive installation was completed early in 1955 in the New York City downtown area by Lorson Electric Co., Inc., and greatly expanded two years later by the same firm. It consists of seven 2½" conduit risers running up the exterior wall of the inner court of a 26-story building. Two principal considerations prompted the use of aluminum: the difficulty of outside maintenance; and the desire to utilize as supports existing shutter brackets, which it was thought would be too weak to support steel conduit.

All fittings are of aluminum except the steel support boxes, which are very large to provide for future expansion and are installed every 50 feet. To minimize the possibility of galvanic corrosion, these boxes and all steel hardware were hot-dip galvanized after all fabrication was completed.

Installation was made from two simultaneously rigged painters' scaffolds. Consequently, labor costs were high. However, the contractor feels that a considerable labor saving was effected in the installation. This resulted from the light weight of the conduit sections (18 pounds for a 10-ft aluminum section as against 53 pounds for the same steel conduit) which permitted the men to work with greater speed and safety under these dangerous conditions.

At that time aluminum costs were about 50 percent above steel. However, the owner's engineer feels that because of the labor savings the final cost was not greater and perhaps less than a steel installation would have been. Furthermore, additional structural supports were not required, and maintenance has been eliminated.

Expansion of Outdoor Installation

Subsequent inspections of this installation revealed no observable deterioration or corrosion on the aluminum conduit or its galvanized pull boxes and accessories. Therefore, as a result of the unqualified success of the initial installation, 17 additional 2½" aluminum riser conduits were installed at the same location in May 1957. Estimates for the additional conduit installation were prepared by the contractor for both aluminum and steel. These were $13,500 for the steel conduit and $12,150 for the aluminum conduit.

Table 1 is an estimated breakdown of these costs, based on the price of conduit existing at that time and allotting 10 percent for profit and 15 percent for overhead.

The estimated total labor savings of 28 percent, as well as the conduit labor savings of 43 percent, are considerably higher than the labor savings obtained from both the "conservative" and "possible" estimates. This increase is attributable to the unusually difficult and hazardous labor conditions encountered on this job.

This installation, incidentally, is illustrative of an excellent and economical way to increase electrical capacity of large, inadequately wired old buildings, particularly where inner shaft space is lacking and it is inconvenient as well as costly to break through multiple floor slabs. This is a situation increasingly encountered in major cities under

the twin impacts of increasing air conditioning and lighting demands.

Aluminum Conduit in Large Commercial Buildings

The recent decision, based on competitive bids, to use aluminum conduit for sizes 1½" and larger in the new 60-story Chase-Manhattan Bank office building in lower Manhattan is serving as a spectacular illustration of the potential of aluminum conduit. The choice of 1½" conduit as the crossover size reinforces our previously derived conclusions.

Modern office building electrical systems generally are designed to provide an over-all demand of about 10 watts per square foot for lighting and small power in the office spaces. This quantity of power requires massive electrical risers. Two different types of power riser construction are used: cable and conduit; or low impedance busway. The choice depends on the design engineer's preferences and prejudices. The question of relative economics is a complex one and is hotly debated, with contradictory opinions held by reputable engineers.

When low impedance busway is chosen, it usually will be aluminum busway, which is at this time about 20 percent less expensive than copper busway of similar capacity. Many large structures in a number of major cities have been designed with low impedance bus risers. This sharply reduces the amount of large conduit required.

In a recently completed New York City office building of about one-million square feet, equipped with low impedance aluminum busway risers, about 310,000 feet of ¾", 1", and 1¼" steel conduit, totaling about 365,000 pounds were installed. About 260,000 feet (295,000 pounds) of this was ¾" conduit. The total of all the larger conduit (1½" to 4") was only about 32,000 feet and weighed about 157,000 pounds, less than half that of the smaller sizes.

In contrast, the Chase-Manhattan building, a structure about twice as large, uses a cable and conduit riser for power distribution. The smaller conduits, ½", ¾", 1" and 1¼", total 640,000 feet of conduit weighing 690,000 pounds in steel. Of this amount, ¾" conduit constitutes 600,000 feet weighing 630,000 pounds. The total large conduit to be used in this building is estimated at about 138,500 feet and its weight at about 820,000 pounds of steel (about 286,000 pounds in aluminum), about one and one-fifth times that of the smaller conduits.

Therefore, in structures with cable and conduit risers, greater savings may be expected by using aluminum conduit because a greater proportion of the conduit is in the larger sizes. However, the contractor or engineer may find it economical to go to aluminum in the smaller as well as the larger sizes, if he obtains a more favorable over-all price discount for the larger total quantity.

Generally, it may be expected that the use of busway for power risers in large office buildings will cut the large conduit requirements by more than half. Here, the savings obtained by using aluminum conduit may tend to be somewhat less because of the lesser quantities involved. However, these amounts still will be measured in carload lots (30,000 pounds) and maximum discounts generally should be obtainable.

Longer Standard Lengths?

The lighter weight of aluminum conduit raises the possibility of using lengths longer than the standard 10 feet. A length of 20 feet still would be 30 percent lighter than a standard 10-ft length of steel conduit. Double lengths would provide substantial labor savings on long runs. However, the major codes (National Electric and New York City) specifically call for 10-ft standard lengths, and the electrical unions may be expected to oppose any change. There is a strong argument for keeping 10-ft lengths in that the closely spaced couplings provide a ready and safe differentiation from plumbing and heating pipes. But this argument hardly can be considered relevant for conduit in concealed locations or in identified electric shafts reserved solely for electrical equipment.

Properties of Aluminum Conduit

Aluminum conduit is different from steel conduit, and consulting engineers should examine these dif-

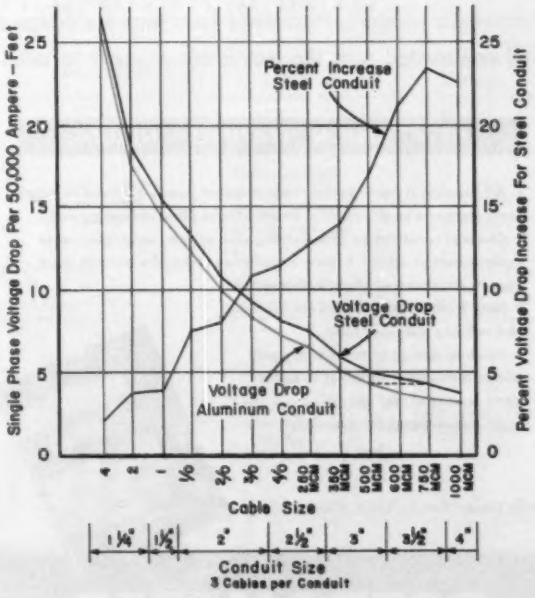

Single Phase Voltage Drop Per 50,000 Ampere – Feet
Percent Voltage Drop Increase For Steel Conduit
Percent Increase Steel Conduit
Voltage Drop Steel Conduit
Voltage Drop Aluminum Conduit
Cable Size
Conduit Size
3 Cables per Conduit

Fig. 4—Voltage drop comparison for steel and aluminum conduit with copper cables, 80% pf.

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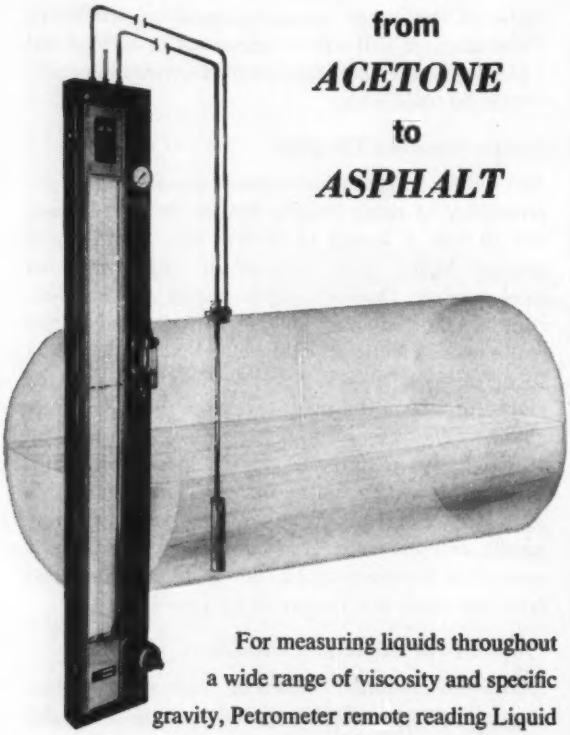

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ferences and become familiar with comparative advantages and disadvantages.

Aluminum conduit is far lighter than steel conduit. It weighs 35 percent as much as steel conduit.

The aluminum alloy used for conduit is not as strong as steel. However, high strength, in itself, is not a requirement of electrical conduit. It is more important for a conduit material to possess the proper combination of ductility, strength, and percent elongation, enabling electricians to form bends accurately, easily, and without distortion. These requirements are met by a magnesium-silicide alloy, industry designation No. 6063, with a T42 temper (a half-hard temper obtained by heat treatment and natural aging). This alloy has a guaranteed minimum tensile strength of 22,000 psi in the temper used for conduit, a yield point at 13,000 psi, a Brinell hardness of 42, and a total elongation of about 20 percent.

The steel used for conduit is a soft to mild low carbon steel with about the same elongation and about twice the ultimate strength, tensile strength, and hardness of 6063 aluminum.

Voltage Drop

A desirable dividend resulting from the use of aluminum conduit is a lower voltage drop, particularly for large feeders. This factor, in the larger sizes, often may determine the size of a conductor, particularly for low source voltages.

The lower voltage drop occurs because aluminum is nonmagnetic and therefore is not subject to magnetically induced energy (hysteresis) losses. This property also makes possible the use of aluminum for isolated phase enclosures where the powerful magnetic fields, uncanceled by the opposite phases, would cause excessive heating in steel enclosures. In other words, aluminum conduit can be used to carry or protect a single current-carrying cable.

Fig. 4 compares voltage drop for the common range of copper cable sizes in aluminum and steel conduits. This graph shows:

¶ A lower voltage drop occurs for aluminum conduit throughout the entire range of cable sizes.

¶ The percentage difference in voltage drop is much greater for the larger cable and conduit sizes, ranging from about 2 percent for No. 4 wire to about 23 percent for 750 and 1000 MCM cable.

¶ Significant voltage drop differences due to conduit material appear limited to 2″ conduit and larger sizes. For the smaller sizes, the resistance of the wire is by far the dominating factor.

Curves are similar for other power factors. They tend to be closer together for higher power factors and farther apart for lower power factors.

Three 500 MCM conductors in 3″ aluminum conduit have the same voltage drop as three 750 MCM

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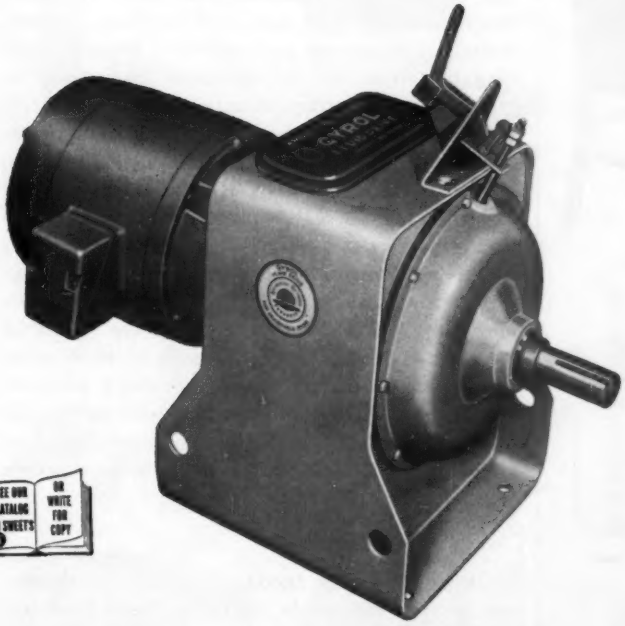

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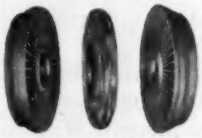
GYROL FLUID DRIVE Type VS, Class 2 	Vortex of oil isolates shock.	Good—few wearing parts; extra-long service life.	Simple, wear-free speed control.	Unlimited—all Gýrol Fluid Drive ratings are for continuous service.	Units available up to 800 hp.
FRICTION-TYPE DRIVE	Mechanical connection transmits shock.	Poor—multiple wearing parts; power transmitted by friction.	Wear and tension affect control.	Limited—service factors influence selections.	Units available up to 100 hp.

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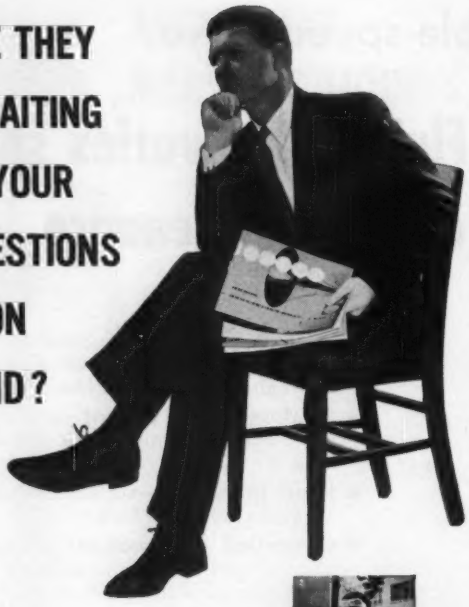

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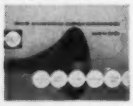

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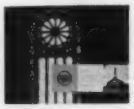

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conductors in 3½" steel conduit. Likewise, three 350 MCM conductors in 2½" aluminum conduit have practically the same voltage drop as three 500 MCM conductors in 3" steel conduit. This is important in the consulting engineer's selection of feeder sizes for client applications such as 120/208-volt lighting loads.

Resistance to Corrosion

The excellent resistance of aluminum to atmospheric and chemical corrosion has been demonstrated by numerous and extended exposure and laboratory tests and by countless applications in the process industries. Aluminum is particularly resistant to acidic atmospheres and adequately resistant to caustic or alkaline atmospheres although soluble in the stronger bases (sodium and potassium hydroxides). Consequently, aluminum is replacing many ferrous alloys in highly corrosive industrial atmospheres.

Numerous tests conducted with various aluminum alloy specimens exposed to severe industrial and marine atmospheres for periods up to 50 years have indicated that any corrosive attack tends to be self-stopping, apparently the result of the inhibiting action of the aluminum corrosion compounds formed. Thus, most of the corrosion occurs within the first year.

Galvanic Corrosion

Because of its highly anodic position in the electromotive series for metals, aluminum has a tendency to enter into destructive electrolytic cell combinations with some of the common metals. However, electrolytic action requires both moisture and electrolyte. If neither of these elements is present, corrosion will not occur. Thus, in dry locations or in corrosive outdoor locations where frequent rains tend to wash away electrolytic chemical formation, aluminum may be placed in contact with more cathodic metals.

Nevertheless, it is well, particularly in outdoor locations, to provide aluminum conduit runs with aluminum fittings and aluminum supports. This is easily done, since aluminum conduit fittings are readily available as standard items, often at the same prices as their cast iron equivalents. It is important in very corrosive locations, such as marine atmospheres, that the aluminum of the fittings be relatively free of copper content, since destructive galvanic couples could be set up between these two metals which are widely separated in the electromotive series.

Aluminum conduit may be used satisfactorily with cast iron fittings providing these are thoroughly galvanized. The zinc appears to have a protective cathodic action between the aluminum and iron.

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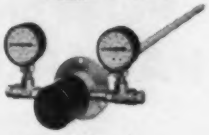

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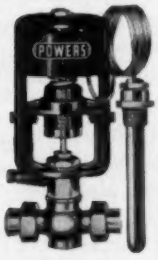

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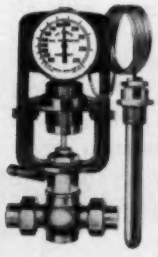

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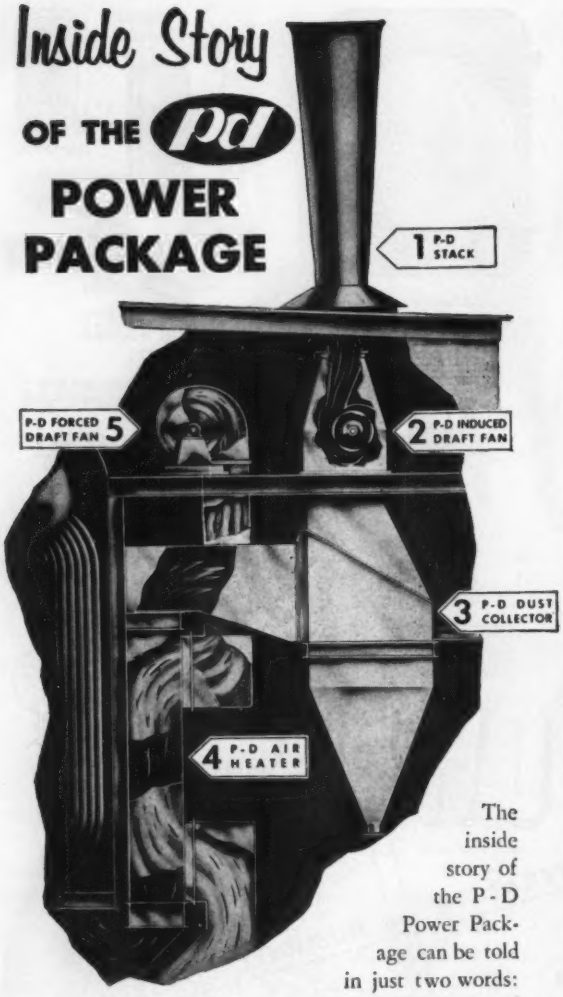

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Stainless steel fittings and attachments also have been satisfactory in service.

Installing Exposed Aluminum Conduit

The same precautions that ordinarily would be taken with steel conduit usually are sufficient for the installation of exposed aluminum conduit. It is important to keep the conduit from close contact with other materials which would permit moisture to accumulate. This is particularly true for absorptive structural materials such as wood, or thermal insulations such as cork or glass wool. This condition can create oxygen concentration cells, and the continuously wet, oxygen-starved surface becomes anodic with respect to the adjacent drier surface and deteriorates electrolytically. Consequently, an air space or a moisture barrier should be provided between support structures and conduits.

Another advisable precaution is to avoid installation of aluminum conduit where washes or drainage from large area nickel or copper installations (such as roofing or copings) can spill onto the surface of the conduit. Extensive wash from metals highly cathodic to aluminum can cause severe corrosion.

Drainage from freshly applied building materials such as concrete, plaster, stucco, and asbestos cement products containing alkalines or chlorides, will cause superficial attack, which is quickly self-limiting. The discoloring and staining that occurs can be prevented, if desired, by the application of a clear lacquer.

Installing Concealed Aluminum Conduit

Many engineers and contractors have asked whether aluminum conduit can be safely installed in concrete slabs or floor fills. This apprehension among contractors and engineers probably stems from the knowledge that aluminum reacts with highly alkaline materials and that mortar, concrete, and other nonmetallic building materials contain Portland cement, quicklime, magnesium compounds, or other alkaline compounds. Actually, one has but to look about to discover many instances where aluminum handrails, building facing, pipes, grills, and structural elements are not only buried in concrete but also partially immersed or in close contact – conditions often more susceptible to corrosive attack than complete concealment.

Considerable testing has been conducted to determine the compatibility of aluminum with alkaline building products. The general conclusion has been that no harmful corrosion occurs. The hydroxides of calcium, magnesium, and ammonia in building materials cause only mild surface attack which produces self-limiting films. Reaction occurs only in the initial stages of exposure. Upon subsequent curing and aging, the initial protective film

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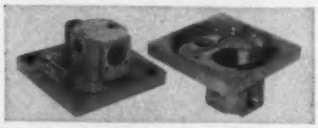

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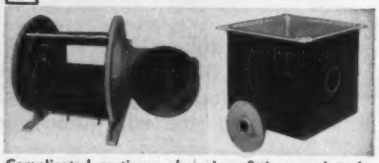

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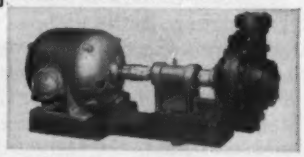

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changes gradually to form an even more inert barrier against corrosion.

Aluminum conduit generally offers excellent corrosion resistance when directly buried in soils. However, because of the many variables involved and the increased possibility of corrosive attack by galvanic action, oxygen concentration cells, and stray electric currents, an inert organic coating should be applied. The least expensive and easiest to apply are the bituminous or asphalt base paints, which require only the removal of grease and oil deposits from the surface. Where appearance is a consideration, aluminum powder pigment can be added to the paint or clear methacrylate lacquer used instead.

Effects of Calcium Chloride

The application of organic protective coatings for conduits buried in soil or in below grade concrete floors where moisture tends to remain is an advisable precaution for steel as well as aluminum conduit. This is a standard specification in many engineering offices.

Reports of extremely severe corrosion of uncoated aluminum conduit in concrete occasionally have been noted. One instance of unusually heavy corrosion of aluminum conduit in concrete floor slabs in a Canadian hospital was the subject of an extensive investigation reported in *The Engineering Journal*, a Canadian publication. After lengthy and numerous tests, the conclusion was reached that the deterioration was due to heavy concentration of calcium chloride admixture which resulted in excessive galvanic corrosion between the reinforcing steel and the aluminum conduit. Harmful corrosion occurred only when both the calcium chloride and the steel were in the slab with the aluminum. And the action continued even in the apparently dry slab. The explanation appears to lie in the fact that calcium chloride is a wetting agent and apparently was able to entrain or attract sufficient moisture to provide a conducting medium capable of maintaining harmful galvanic corrosion.

Other Concrete Admixtures

Calcium chloride has been used during winter weather as an accelerator and densifier admixture for concrete. However, its use is avoided as much as possible since it has harmful effects on steel and other materials as well as aluminum. There are many accelerating admixtures for cold weather work, such as Sikacrete and Pozzolith, which contain little or no calcium chloride and which will not cause appreciable deterioration of either aluminum or steel imbedded within or impinging upon the treated concrete mixtures. For cold weather work the engineer should firmly specify the ad-

How Much Steam Should a Steam Trap Trap?

. . . some answers to commonly asked questions about the primary job of a steam trap

You don't need a doctor's degree in thermodynamics to answer the question at the top of this page. Naturally, a steam trap should trap *all* the steam.

Unfortunately for you, the problem isn't quite that simple. After all, a shut off valve would trap all the steam . . . and condensate, and air, and carbon dioxide as well.

So we'd better amend the answer to the question this way: A steam trap should trap *all* the steam but *must* remove condensate, air and carbon dioxide as rapidly as they accumulate.

With this established, let's take a closer look at what's involved:

A Steam Trap Should Trap All The Steam

If you've had experience with several different makes of traps, you already know that some trap steam better than others. The operating principle of the trap is what makes the difference. We like to talk about it because Armstrong traps are designed so that no steam can get to the orifice. The valve is always water sealed. Result: *More efficient steam utilization, lower fuel costs.*

A Steam Trap Should Remove Condensate

All traps remove condensate—after a fashion. For maximum efficiency in the unit being drained, though, the trick is to get it out without waiting for it to cool and without leaking steam.

Armstrong's water sealed valve takes care of steam leakage. The inverted bucket operating principle opens the trap for water regardless of its temperature. This means you get the condensate out as quickly as it accumulates. Result: *Higher temperatures and better heat transfer in steam heated units.*

A Steam Trap Should Remove Air and CO_2

Part and parcel of the condensate removal problem is removal of air as well as oxygen and carbon dioxide—two real troublemakers. Air tends to reduce operating temperatures and interfere with heat transfer. CO_2 goes into solution to form corrosive carbonic acid which, for example, can eat unit heater tubes. O_2 aggravates the situation. Believe it or not, but all traps don't properly remove air and CO_2.

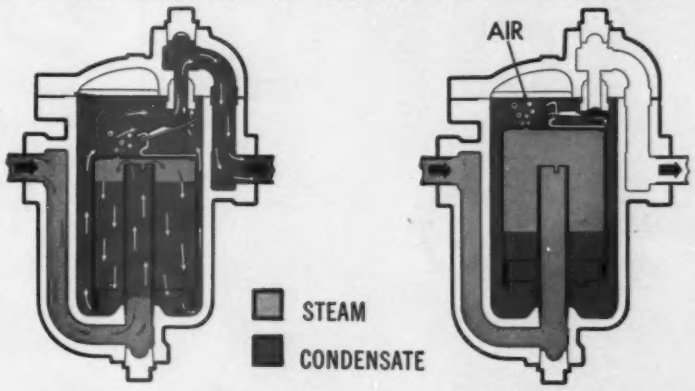
By now, you've probably guessed that Armstrong traps *do* remove air and CO_2. Armstrong design (see illustration) provides continuous venting of air and CO_2. By opening suddenly, the Armstrong trap creates a momentary pressure drop to "pump" the air down to be vented. Result: *Higher temperatures, faster heat-up, better heat transfer and reduced corrosion.*

Note: When required, specially sized air vents are furnished. For fast heat-up of low pressure on-and-off units, Armstrong provides open float and thermostatic air vent traps.

What's the Final Answer?

Summing it all up, you'll get the best service from steam heated units that are equipped with traps designed to trap *all* the steam and remove air and condensate as quickly as it accumulates. In our prejudiced viewpoint, this means Armstrong traps. More important are the several thousand users of Armstrong traps who have proved the point.

HERE'S THE STEAM TRAP DESIGN THAT GETS RID OF CONDENSATE AND AIR WITHOUT STEAM LOSS



Trap open. Condensate entering trap has caused bucket to lose buoyancy. Weight of bucket times leverage pulls valve open. Air is discharged along with condensate.

Trap closed. Steam has floated inverted bucket; valve is held tightly closed by system pressure. Air entering trap passes through bucket vent and accumulates at top of trap.

Before you make up your mind, though, consider the minimum maintenance requirements of Armstrong traps . . . and the convenient assistance your local Armstrong Representative provides. These are important plus values.

Put Up or Shut Up

We're so confident that we "put up". Armstrong traps are unconditionally guaranteed to satisfy. So you can find out for yourself with practically no risk. If you're not completely satisfied with the way they do their job, you can get your money back.

* * *

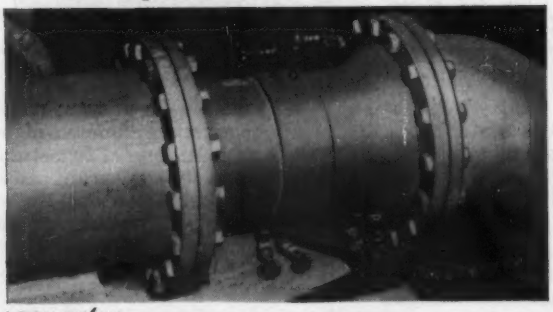
The 44-page Armstrong Steam Trap book goes into greater detail on these and other Armstrong features. It also discusses trap selection, installation and maintenance. Ask your Armstrong Representative for a copy or write

Armstrong Machine Works
9655 Maple Street
Three Rivers, Michigan

ARMSTRONG STEAM TRAPS

PIPING LAYOUT IS SIMPLER

...they need so little room



*GEN-TIL-LY

Gentile Flow Tubes are short. They need only minimum straight runs entering and following, and can be installed at practically any accessible point where flow conditions are reasonably steady.

Flow Tubes are furnished with individual head capacity curves – and for unusual piping arrangements, calibration curves for simulated conditions can be furnished.

Guaranteed **Accuracy • Reproducibility**
Minimum Head Loss

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835 LEHIGH AVENUE UNION, N. J.

AUTOMATIC VALVES • CONTROL VALVES
SAFETY VALVES • FLOW TUBES

mixtures to be used and check to see that his specifications are observed.

Aluminum Conduit Working Techniques

From a knowledge of the properties of aluminum and steel conduit, and from experience on actual projects, it is clear that installations of aluminum conduit should not give an experienced contractor any trouble. Aluminum conduit should be easier to bend and form than steel. Although aluminum is softer, crushing is not a problem, for less force is required for the same bends. In practice, contractors use the same bending tools for both steel and aluminum. Most contractors state that bending aluminum conduit is easier.

More complaints have been received about threading aluminum conduit than about any other conduit operation. These difficulties appear to originate mostly in the use of relatively dull dies intended for steel conduit. Many contractors who have made extensive aluminum conduit installations feel that no more difficulty is involved than when threading steel; some say it is actually easier.

Because aluminum conduit has less hardness and tensile strength than steel conduit, special attention must be given to the threading technique for aluminum. Dies always must be sharp to avoid tearing the softer metal. It is desirable that dies, particularly for the larger conduit sizes, have an increased "hook" or "rake" top angle – about 35 degrees – to make the dies self-cleaning. It is important not to bump the threaded ends.

With hand and power threading tools, a conventional cutting oil should be used. The optimum lubricant would be a petroleum oil, having a viscosity of approximately 150 SSV at 100 F, and fortified with sulfur and/or chlorine additives.

The smaller sizes of aluminum conduit always should be cut with a hacksaw, never with a wheel-cutter, which has a tendency to reduce the diameter.

In joining aluminum conduit an anti-seize compound always should be used. Suspension of zinc dust in petroleum jelly or graphite in heavy cup grease is recommended. It is important to bring up joints tight to prevent snags in wirepulling. Forcing or bumping should be avoided.

Precautions for Wirepulling

Aluminum conduit can be stored and also left lying about without fear of the threads corroding. However, threaded ends should be protected to prevent the accumulation of dirt and abrasive particles.

Wirepulling through aluminum conduit is another operation that has brought contradictory comments from installers. The interior of aluminum conduit is coated with stearic acid, which imparts slipperiness and low friction. It is recommended that a

YORK

to make ice rink history in the 1960 Olympic Arena with fantastic new heat pump installation

Artist's drawing of the new Olympic Ice Rink at Squaw Valley, Calif. Architects are Corlett & Spackman, A.I.A., Kitchen and Hunt, A.I.A., Architects Associated. Engineers: Vandament & Darmsted, San Francisco.

PROVIDES ALL 3—

1. **Refrigeration for over 120,000 sq. ft. of ice rink surface**
2. **Heat for spectator areas and all service facilities**
3. **Heat for domestic hot water and the arena snow melting system**

Again, the tremendous potential of the Heat Pump for practical commercial applications is dramatically demonstrated in the York installation for the 1960 Winter Olympics' largest building. A single system will provide over 550 tons of refrigeration at 5° F. for the arena's four huge skating rinks plus more than 5 million BTU's per hour for heating. The arena's 600 meter rink will be the "largest expanse of artificial frozen ice ever refrigerated for skating competition".

York has custom-built, to specifications, refrigeration for such outstanding skating rinks as Yale University; the Steinberg Memorial Rink in St. Louis, Mo.; Lake Placid Arena; Wollman Memorial Rink in Central Park, NYC.—and welcomes inquiries from municipalities, universities, architects, contractors, engineers and private groups. For full details on these installations, and what York can do for you, write Dept. CE, York Corporation, York, Penna.

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terminal ball always be used on the ends of fish tapes to prevent a sharp tape end from digging into the conduit at bends or catching on inadequately closed joints. Comparative wirepulling tests by the Aluminum Company of America on aluminum and steel conduit runs with multiple bends actually have indicated easier pulling through the aluminum conduits. For additional lubrication, talc or powdered soapstone is recommended.

Although some vehement complaints have been voiced by contractors, these would appear to be occasioned by violations of proper procedure — such as installing insufficient pull-points or using wide tapes in aluminum tubing. Hundreds of thousands of feet of aluminum conduit have been installed and wires and cables successfully pulled into them with no particular difficulties.

Obstacles to Using Aluminum

At present, certain obstacles militate against the more extended use of aluminum conduit, despite the favorable economic and technical considerations which have been discussed. Most of these arise from the newness of aluminum conduit, and the basic resistance to change with which any new product must contend.

A good deal of misinformation and half-information exists. For example, some contractors and engineers still feel that aluminum conduit must be used only with aluminum boxes, because of galvanic corrosion. Aluminum sheet metal boxes are considerably more expensive than sheet steel boxes. This additional cost, if added to the cost of an aluminum conduit installation, very well could tip the decision away from aluminum. Even in the electrical installation for the Alcoa Building, galvanized sheet steel boxes were used. Five years later no destructive action between the two metals has been noted.

The fact that aluminum conduit often is not available as a stock item long has been a deterrent to popular acceptance. Many of the major electrical supply houses do not at this time stock aluminum conduit. They point out that demand has not justified it. This is a disadvantage which is rapidly declining as a result of changed economics.

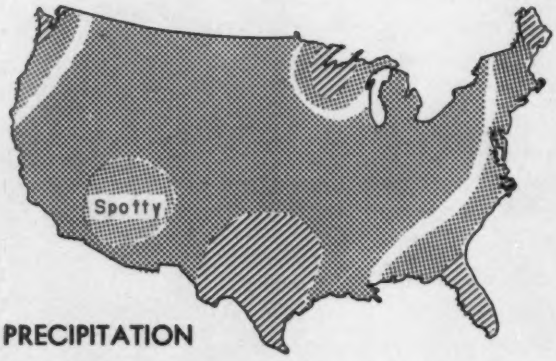
Finally, there exists another major block in that consulting engineers, undoubtedly more from force of habit than anything else, frequently rule out aluminum conduit by specifying only steel conduit. Thus, even if the contractor wanted to use aluminum conduit, he would have to obtain a specification change or a special approval.

Although the use of aluminum conduit is hampered by these factors, its application is bound to increase greatly, particularly in large electrical installations where it provides the greatest economic advantage. ▲▲

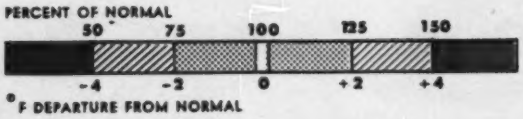
KRICK WEATHER OUTLOOK

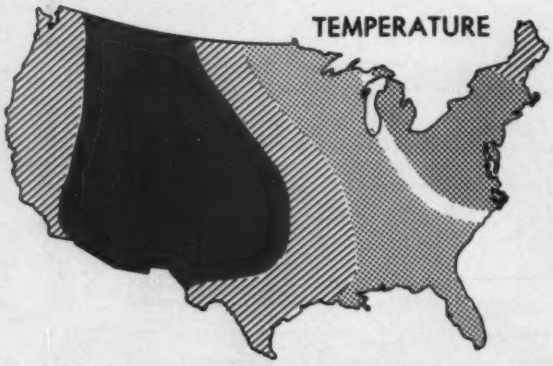
SEPTEMBER 1958

Prepared Exclusively for CONSULTING ENGINEER



PRECIPITATION





CONSTRUCTION DAY FORECAST LOCATIONS

CONSTRUCTION DAY CRITERIA

To be considered a construction day on these charts, the day's maximum temperature must be more than 38 degrees. There must be less than six inches of snow on the ground. There must be less than six hours of active precipitation between the hours of 7 a.m. and 5 p.m. There can be no more than one inch of rain on the preceding day.

SEPTEMBER HIGHLIGHTS

September 1958 will be featured by warm weather over the U.S. Temperatures will average above normal everywhere except in the extreme northeastern portion of the country where readings will average one to two degrees below normal, with Maine and extreme northern New England from two to four degrees below normal. Over the vast Rocky Mountain-Great Basin-Southwestern area, temperatures will average more than four degrees above normal. Precipitation will be rather spotty during the month, and generally will be centered around the coastal regions of the east. Extreme northern New England and the Florida peninsula can expect precipitation to total from 25 to 50 percent above normal. All other east coast areas can expect precipitation around 25 percent over normal. Fairly good showers around the western end of the Great Lakes region will boost precipitation there above normal for the month. Construction should be favored in the southcentral U.S., where precipitation generally will run only slightly more than half of normal. The expected occurrence of three tropical type storms will bear watching in the east and southeast this month. Disturbances are expected in the Gulf around the 19th and 28th, with a Cape Verde type storm expected to develop around the West Indies around the 10th. It will move northward along the Atlantic Coast. The western Plains, the Rockies, the Southwest, and the Great Basin areas will offer nearly ideal construction weather during September.

TEAR OUT ALONG PERFORATION.

These forecasts are prepared by Irving P. Krick Associates, Inc., the world's oldest and largest weather engineering firm. The forecasts are based on methods developed by this group at California Institute of Technology prior to World War II. After the War, the methods were adapted to high speed electronic computing machines to shorten the time required to solve the complex problems of the atmosphere. Ultra-long range forecasts, up to a year or more in advance, are now available. Information on other Krick weather services is available by writing to the home office of the firm at 460 South Broadway, Denver, Colorado.

CONSTRUCTION DAYS

SEPTEMBER 1958 ESTIMATES															
LOCATIONS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
HIGHEST	30	30	30	30	30	30	30	30	30	30	30	30	30	29	30
LOWEST	26	30	28	28	28	25	25	25	24	26	28	25	22	24	27
AVERAGE	27	30	30	29	30	29	28	29	28	29	29	28	26	27	29
ESTIMATE	28	30	30	30	30	30	29	29	29	30	30	28	27	27	28

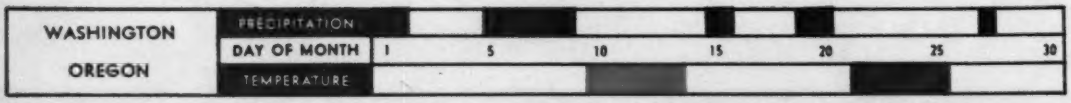
These estimated construction days for key cities in the United States should be interpreted as an average of estimated conditions over the forecast area. To obtain the best results, the forecast number of construction days should be compared with the temperature and precipitation anomaly maps and the timing estimates to determine the probable number of construction days in your locality. The forecast construction days are based on average construction day requirements as defined under "Construction Day Criteria," and should be adjusted for individual operations.

OCTOBER AVERAGE AND RANGE*															
LOCATIONS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
HIGHEST	30	31	31	31	31	31	31	31	30	31	31	31	31	30	31
LOWEST	16	28	29	25	30	25	26	21	26	26	28	25	26	28	22
AVERAGE	25	30	31	29	31	29	30	28	28	29	29	29	29	29	27

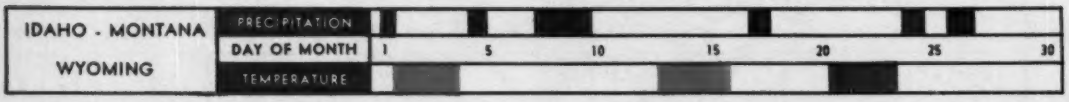
NOVEMBER AVERAGE AND RANGE*															
LOCATIONS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
HIGHEST	26	30	30	29	30	30	30	27	30	30	27	29	29	30	27
LOWEST	16	21	24	16	22	15	21	6	18	21	13	21	18	22	17
AVERAGE	21	26	28	22	28	21	27	15	25	27	21	25	23	27	22

*Historical Average, Not a Forecast

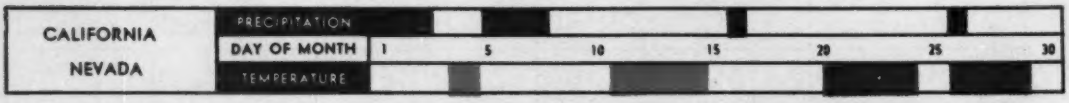
SEPTEMBER 1958 TIMING OF S



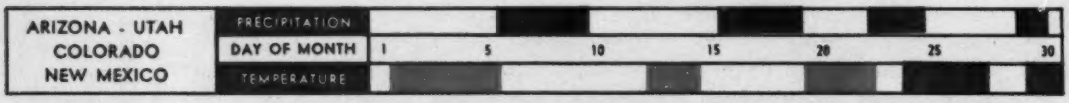
Temperatures during warm period will be in 90's inland and in 70's in coastal areas. Lowest minima in cool period will be near freezing inland and in 40's along coast. Frequent fast-moving Pacific storm systems will bring above normal precipitation west of the Cascades.



Storm period just prior to 10th is not important in Montana. Precipitation around 25th will be most important east of the continental divide and will contain occasional snow. Lowest minima in the cool period will be around freezing at lower elevations.



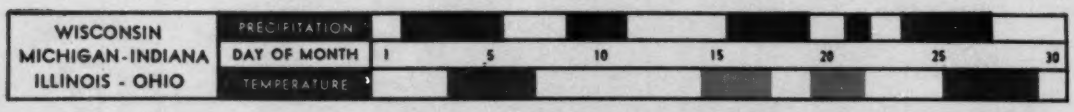
Fall rains will start early in northern California, bringing above normal precipitation in extreme coastal area but will drop off after 10th. Showers following mid-month are important only in Nevada. There will not be any subfreezing temperatures at lower elevations.



Precipitation period indicated between 5th-10th will be most important in northern Utah and Colorado. Showers prior to 25th are most important in Arizona and New Mexico, while those following 15th will be most important in the eastern part of this area.

Showers prior to 10th are most important in South Dakota and southern Minnesota. Most of the precipitation in this area will occur during the latter half of the month. Subfreezing temperatures with killing frost are likely around 24th.

Although frequent precipitation is indicated for this area, it will be mostly as showers and will not be heavy. Temperatures during the cool period toward the end of the month will be cool, but will remain above freezing.



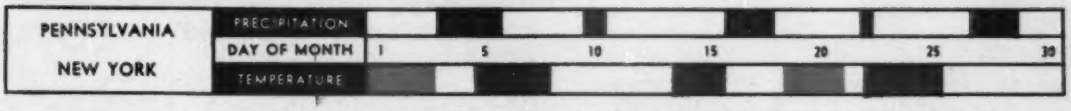
Strong winds are likely near the Lakes during the storminess indicated around 17th and 18th. Precipitation around western end of Great Lakes region will be above normal. Subfreezing temperatures are not expected during indicated cool periods.

SIGNIFICANT WEATHER EVENTS

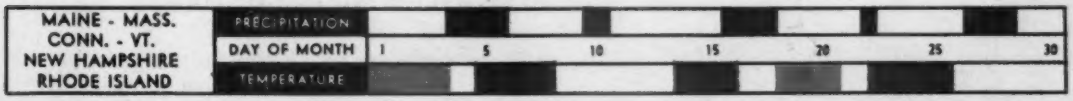
RAIN
SNOW
WARM
COOL

The timing bars below are intended to indicate periods of important general storminess and important departure from temperature normals in areas indicated. They are highly accurate over the area indicated, but are too general to pinpoint small local storminess or showers. Allow one day on either side of indicated storm or extreme temperature periods for general planning. Combination rain or snow shading indicates either one or both.

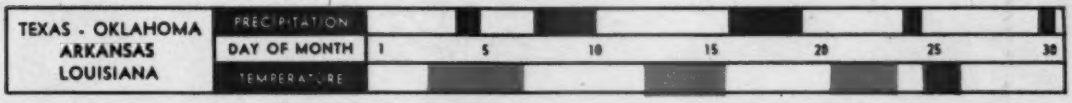
Most important storminess will occur between 2nd and 5th; 16th and 18th; and 26th and 29th. Coastal areas will have above normal precipitation, but the rainfall pattern will drop off rapidly as you go inland. No subfreezing temperatures are expected.



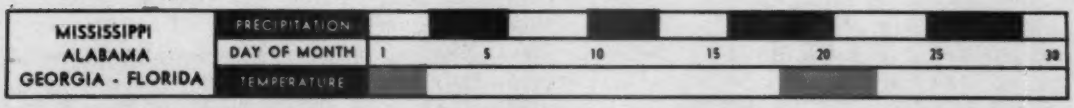
Temperatures during the indicated cool periods will sink to near freezing at the higher elevations, but there will not be any freeze threat at lower elevations. Most important storminess in this region will occur around 5th, 17th, and 28th.



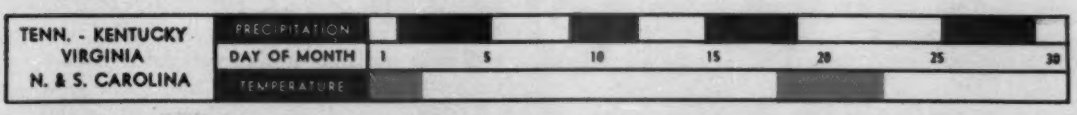
Subfreezing temperatures are likely at the higher elevations during the cool period toward the end of the month, but severely cold weather will be lacking. Occasionally strong winds are expected during the storm periods centered around 5th, 17th, and 28th.



Storminess around 17th-19th is most important in north Texas and Oklahoma. None of indicated storminess is expected to produce much precipitation since the main storm zones are farther north. Temperatures generally will average above normal.



Precipitation on Florida peninsula will occur about one day later than indicated above. Two tropical type storms are indicated for the Gulf around 19th and 28th, and a West Indies storm is expected along the east coast around the 10th.



Storminess at the end of the month should be quite active along the south Atlantic coast. Storm indicated around the 17th will be most important in Kentucky and Tennessee. Region will have near normal to above normal temperatures.

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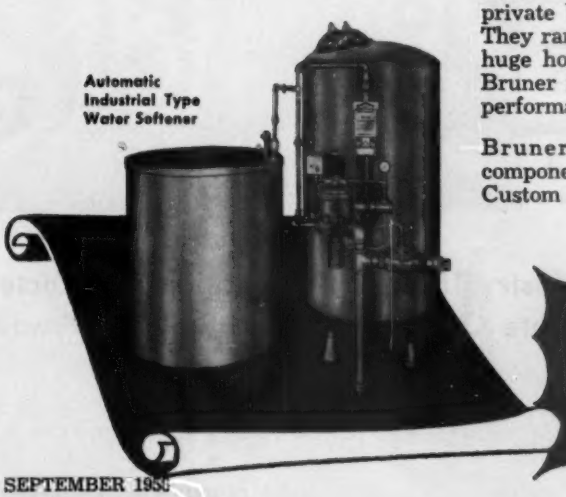

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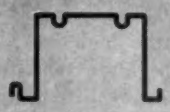
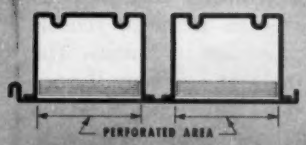
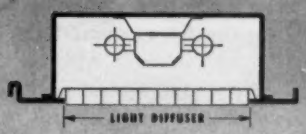


SECTION M1-OB
OPEN BEAM DEPTH 3", 4½", 6" or 7½"



SECTION M2SR (Acoustical)
CEL-BEAM DEPTH 3", 4½", 6" or 7½"



SECTION M1T (Troffer)
DEPTH 6" or 7½"

SECTION M2 (Acoustical)
CEL-BEAM DEPTH 1½", 3", 4½", 6 or 7½"

At Left: Cross Section of Long Span M-Deck Combined Roof-Ceiling with Troffer Lighting.

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of Steel and Aluminum

Report from Austria

RUDOLPH SOBOTKA
Consulting Engineer Correspondent

TRUNCATED BY TWO WORLD WARS and handicapped by chronic shortages of capital, technicians, engineers, and scientists, Austria has been hard-pressed to keep up with the unprecedented technical progress of the past two decades. Austria will have an even harder time in the future, for the engineer shortage is getting worse in this small European country.

CE exclusive

In the years before World War II, Austria was surfeited with engineers. More were graduated than could find work. Many were forced into jobs outside engineering, many emigrated to other countries. Today the situation is reversed.

To fill all the vacancies in the technical professions in 1957, for example, 38 percent more technical school graduates would have been needed. Since some technical graduates go abroad annually, there were two jobs looking for every graduate.

Cause of this unbalanced supply is not any lack of interest in engineering—last year three times as many students applied for admission to technical schools as were graduated—but simply lack of schoolrooms. In addition, University Professor Dr. Ing. H. Kallbrunner feels three things help discourage prospective engineering students: the long duration of study; the rigorous requirements demanded of the students; and the high fees. The first two reasons account for the high standard of Austrian engineers, making them wanted in highly advanced countries.

Dr. Hans Krammer, president of the Austrian Association of Inventors, estimates that only 40 percent of the graduates from technical schools and schools of technology remain in Austria. The rest go abroad, chiefly to West Germany. Losses to the state from this exodus are inestimable. It is a severe drain on the competitive position of Austrian industry and an indirect subsidy for the recipient countries.

Several attempts have been made to remedy the situation. In August 1957 the Austrian committee of the European Federation of National Associations of Engineers (FEANI) sumitted a resolution to the Austrian government emphasizing the primary causes for the growing shortage of engineers:

Schwarzach compensating reservoir, shown here under construction, will have 53 mcf capacity.

Ybbs-Bersenbeug power dam on the Danube. The plant is between the locks and main channel.

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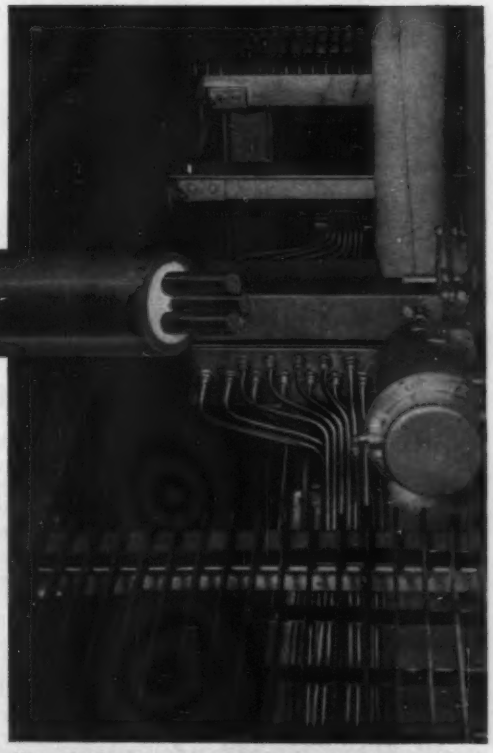

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migration of Austrian engineers to foreign countries and the low wages in prevalent Austrian technical professions.

The next step was an "Austrian Day of Technique" sponsored by engineer and architect associations, schools, and various state offices. Held in Vienna for the first time last October 10-12, it gave representatives of the technical professions a chance to tell their grievances before a forum of Austrian and foreign guests. Public opinion, it was hoped, would rally to support the engineers.

Alarmed by the gravity of the continuing engineering shortage, the government in April established a "Beirat fuer Gesamtfragen der technischen und wissenschaftlichen Fachkraefte" (advisory council for questions relating to technicians and scientists). Represented in the Beirat are all Ministries, the Academy of Sciences, the Association of Industrialists, the Chambers of Trade, Agriculture, and Workers, and the trade unions.

Several practical remedies have been suggested. A proposed loan for new schools and generous scholarships, to which industry was expected to contribute morally and financially, met with no response. Industrialists reasoned that the loan would primarily benefit big enterprises which can afford to hire experienced engineers anyway. Since these basic industries are almost entirely nationalized, private industrialists felt no urge to support the loan.

Professor Kallbrunner suggested that the method of training army surgeons in the Austro-Hungarian monarchy be applied to educate engineers. Under the monarchy the state paid for the student's education. In return, the graduate worked for the state for a given period. "Lack of efficient engineers," says Kallbrunner, "is causing extraordinary difficulties which demand extraordinary measures."

In spite of the shortage, Austrian engineering is still excellent. Said USSR Minister of Power Projects A. S. Pavlenko, after a study tour across Austria: "Although our acquaintance with Austrian industry was only a brief one, we were able to convince ourselves of its high technical standard which, in turn, proves the high efficiency of Austrian engineers."

Hydroelectric Power

Austria has built some exemplary hydroelectric power projects and is destined to become one of the great producers of electric energy in central Europe. Current annual production of installed hydroelectric projects is 10-billion kwh, yet only about 25 percent of Austria's power reserves has been tapped. With power consumption rapidly increasing throughout Europe (Austria's annual consumption alone will jump to 10- to 12-billion kwh in the next decade), Austria has every reason to make its

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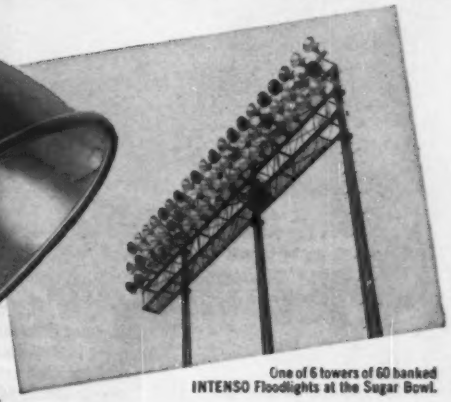
Workman at Sugar Bowl checking INTENSO light before bank is raised to lower height.

Photos courtesy of Tulane University

Opens for Split-Second Rear Relamping



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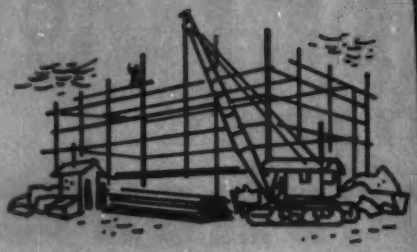

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30-billion kwh reserve available for domestic and continental Europe electric power grids.

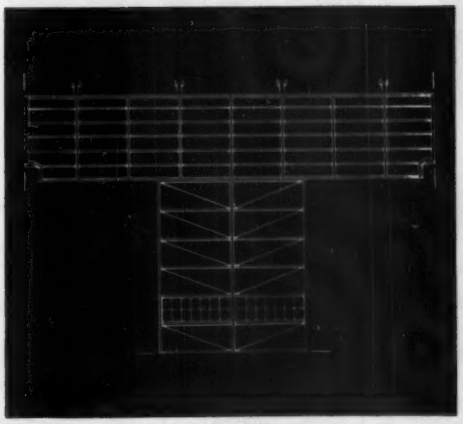
Austria's most power-potent rivers are the Donau (Danube), Ill, Inn, Salzach, Enns, Mur, and Drau. However, water availability varies greatly with the seasons. In spring and summer the water supply is at a maximum. In fall it begins to drop, and in winter, when electric demands are heaviest, the water supply is at the minimum point. This has led to the use of plants combining storage reservoirs and pumping stations with the usual hydroelectric generating facilities. (See "Hydro-Power in Austria's Alps," CONSULTING ENGINEER, October 1953).

But money remains a problem. Using 1-kwh annual production as the basis for comparison, construction costs amount to 7.6 cents for run-of-river power plants, 22 cents for water storage plants, and 3.2 cents for steam power plants. Studying the various types of power plants, consulting engineer Rudolph Schlenk recently figured that, for Austria, expensive water storage plants can produce, in the long run, cheaper current (providing capital is available at moderate interest rates) than less-expensive thermal power plants operating on imported fuel.

Save for the permanent shortage of capital in Austria, far more power dams would be under construction, as most projects have been ready on the drawing board for years. A pet project of the Oesterreichische Verbundkonzern, the state-run electricity company, had to be shelved for lack of financing.

This project envisages a chain of power plants along the Danube River. Generating units with a capacity of 2.1-million kw, producing an estimated 14-billion kwh annually, would be distributed in 14 stages over a 200-mile length, with a net head of about 425 feet. The utilizable water flow would range from 61,792 cfs at the topmost

THIS BYRNE CRANE DOOR



The door illustrated is built with a one-piece, hinged-type upper section and swinging lower sections, all power-operated. Other Byrne Crane Door designs are available to meet any requirements.

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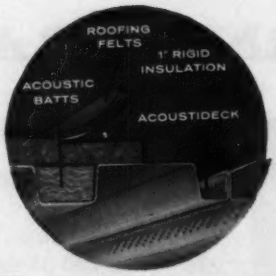

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stage to 81,213 cfs at the lowest. Power plant locations had to be selected not only from a technical but also from an aesthetic point of view. The concrete dams must not spoil the Danube Valley but must fit harmoniously into the landscape of gentle mountain slopes and towering castles.

So far, only two of the projected 14 stages have been finished. Jochenstein, the topmost stage near the German border, was built in cooperation with West Germany. The power output is evenly distributed between both countries, Austria getting approximately 470-million kwh per year.

The second stage, almost completed, is Ybbs-Persenbeug, built at a total cost of $92 million—equivalent to $366 per horsepower or 7.4 cents for an annual kwh. The six Kaplan turbines, probably the largest in use in Europe (wheel diameter 24 feet; net weight 830 tons; gross weight including all accessories about 1040 tons), utilize a water flow of 74,151 cfs.

The installed capacity of Ybbs-Persenbeug (192 Mw) is surpassed in Austria only by the storage power stations at Luenersee (ultimate turbine capacity 270 Mw) and Kaprun (220 Mw). Its power output (1.3-billion kwh) is far ahead of other power stations such as Schwarzach (482-million kwh), Kaprun (465-million kwh), and the Austrian share of Jochenstein.

Other Bilateral Power Projects

As was Jochenstein, the lowermost stage of the 14 Danube power plants will be built in cooperation with a neighboring country. At Wolfsthal, where the Danube runs along the Czechoslovak-Austrian border, the power station construction will be a joint venture with Czechoslovakia.

Because Austria is so small—about the size of Maine—neighboring countries share not only most of the rivers but also an interest in their power potential. A common interest in the Inn and Salzach

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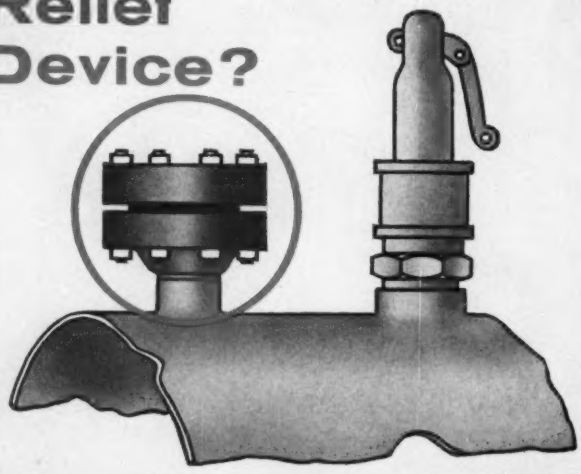

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rivers, which form part of the border between Austria and Germany, was the basis for the Oesterreichisch-Bayrische Kraftwerke AG, coordinating body for Bavarian and Austrian power projects set up in 1950. If Austria gets a World Bank loan, the two will cooperate on the projected Schaerding/Neuhaus power dam on the Inn River. This power plant will produce 545-million kwh per year—193-million kwh in winter, 352-million kwh in the summer.

Understandably, Austria wants to retain the water of energy-yielding rivers as long as possible on its own territory, using storage reservoirs and pumps. For this purpose, more and more storage power stations are to be erected.

Last March the Luenersee water storage plant was put into operation. It currently is Austria's biggest power station and also Europe's highest (6562-ft elevation). It utilizes water from Austria's highest lake, located in the Alps near the Swiss border. The area was perfect for a storage reservoir. The lake's storage capacity was almost doubled (from 1.8-billion cu ft to 3.3-billion cu ft) with a concrete dam 1247-ft long and 92-ft high.

The pumps used to build up water reserves in the storage reservoir during periods of low electric demand also are of interest. They have a capacity of 141.2 cfs against a head of 3281 feet.

Power Plant Conversions

Austria also plans to increase efficiency of existing run-of-river plants by adding storage facilities. For instance, an earth dam 230-ft high and 1509-ft long, using some 91.8-million cu ft of material, could treble the current winter energy output of the 60-Mw Gerlos station.

The Zemm River project also will be expanded. A gravity arch dam 377-ft high and 2034-ft long at the crest, made of 25.8 million cu ft of concrete, will provide 3.3-billion cu ft net storage capacity. A 5.6-mile headwater conduit will

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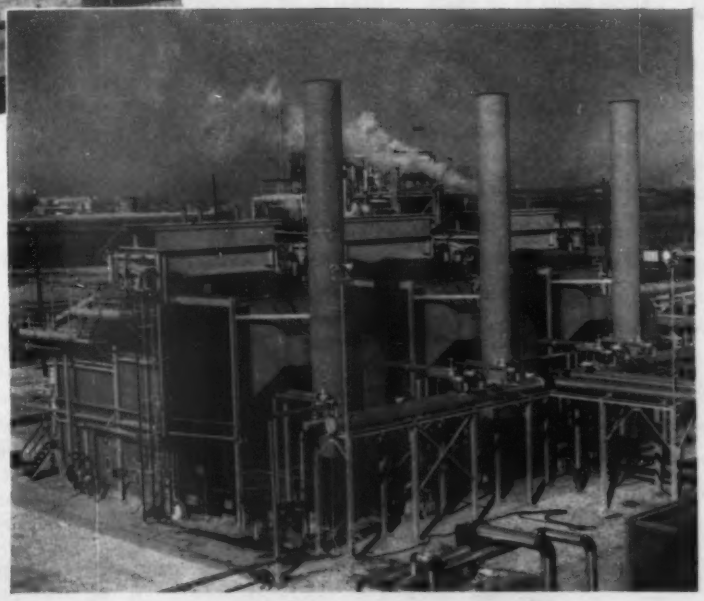

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lead from this reservoir to a 50,000-kw power station, supplemented by pumping sets. The spent water will go through a 5-mile pressure tunnel to another reservoir closed off by a 69-ft dam. From there, another tunnel and penstocks will lead to a 40,000-kw powerhouse. When completed, the Zemm system will have a capacity of 360,000 kw.

Another example is the Schwarzach power plant, whose first generating unit will be put in operation next month. Ultimately this plant will have four generating units with a total capacity of 120,000 kw. Annual energy output will be 482-million kwh, with 34.5 percent available in winter.

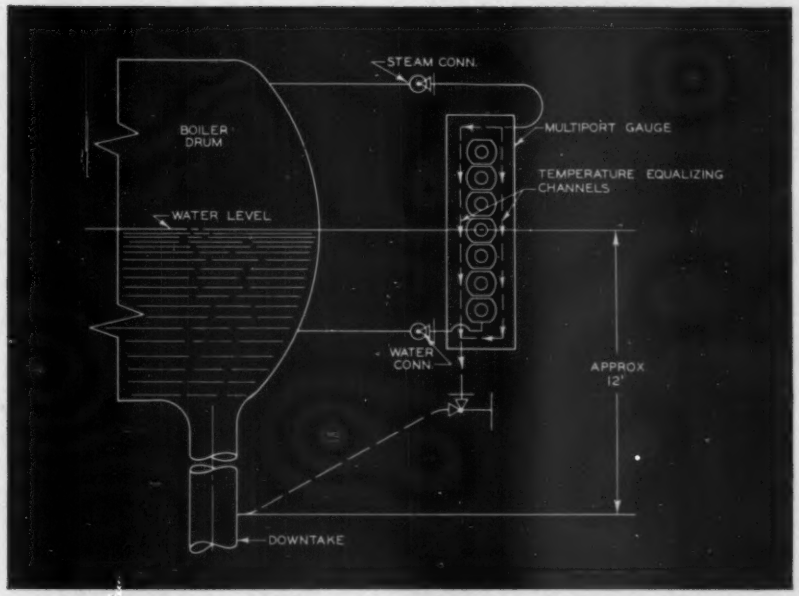
A compensating 53-million cu ft reservoir gives the Schwarzach plant flexible power production. The reservoir is filled not only by the natural flow of the Salzach River, but also by water held for the winter in large storage reservoirs of the Kaprun power plants. This water is used several times in the Kaprun power plant group, then discharged into the upper course of the Salzach River. During periods of heavy electric consumption, both Kaprun and Schwarzach will produce more electric power.

The Schwarzach compensating reservoir was faced with these layers: a filter bed 2½-in. thick, 2 feet of rock, 2½ inches of crushed rock, a layer of asphalt concrete 2½-in. thick, topped with 2½ inches of asphalt concrete plus a mastic cover. The watertight facing is economical and elastic, accommodating itself to possible deflections from varying water loads.

Atomic Power Plants

Although the greater part of its potential water power has not been tapped, Austria is preparing for the advent of atomic power. For a beginning, a state-operated atomic power plant with a capacity of 100,000-150,000 kw is contemplated. Run 5000 hours a year,

ANOTHER NEW GAUGE DEVELOPMENT BY Diamond



Diagramatic illustration of new Diamond Temperature-Equalizing Multi-Port Gauge installation.

The need for correction of inherent gauge error at high operating pressures is well recognized, but heretofore no satisfactory simple answer has been found. Now, Diamond has developed the Temperature-Equalizing Multi-Port Gauge* to reduce the error in gauge level reading by a simple and fully reliable means.

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Ask your local Diamond office or write directly to Lancaster, Ohio for Form 2150 for further information.

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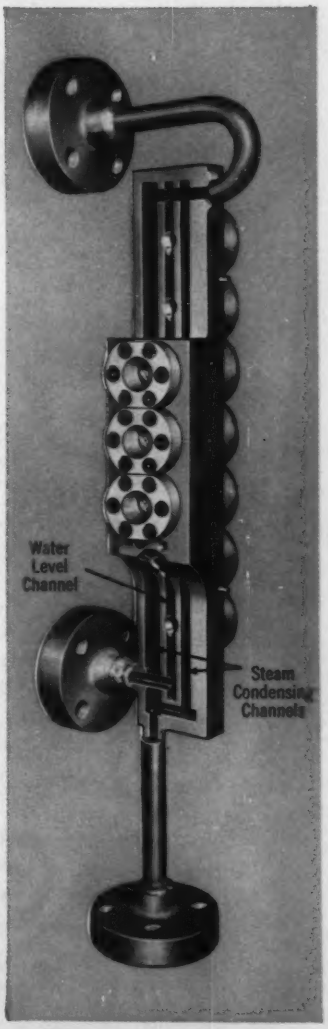

Cut-away sections illustrate independent gauge body heating channels of the new Diamond Temperature-Equalizing Multi-Port Gauge.

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the plant could produce 500-750 million kwh of winter energy.

A more immediate step is construction of an atomic research center at Seibersdorf, near Vienna, to gain experience in nucleonics and train atomic scientists.

The project is centered about a 5-Mw tank-type reactor which will be convertible to 12 Mw. Full details of this AEC-sponsored reactor and other AEC research projects are given in "Beyond our Borders" on pages 168, 170, and 172.

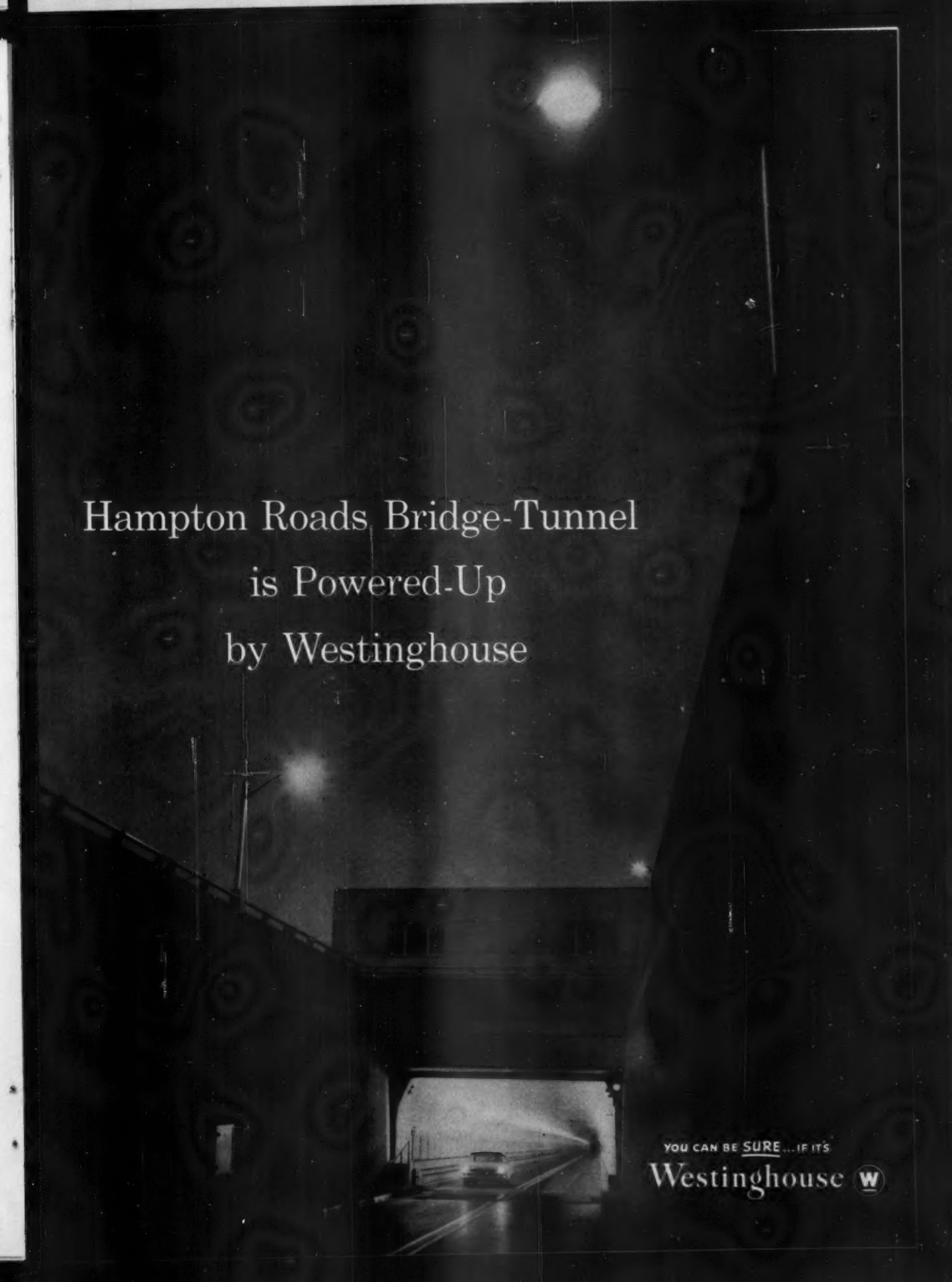
The reactor will be used in a comprehensive research program for radioisotope production and studies of neutron diffusion, transient response, fuel element production, and radiation effects. The fuel, 13 pounds of U235, will be delivered by the U.S.

A number of Austrian graduates of the International School of Nuclear Science and Engineering at Argonne National Laboratory will be on the center's staff. In addition, several members of the government-sponsored Austrian Study Company have been trained at atomic energy installations in the U.S. and other countries.

When Seibersdorf was chosen as the site for this research reactor, the possibility of erecting one more reactor there was taken into consideration. This second reactor would be the one offered by the U.S. to the International Atomic Energy Agency in Vienna, subject to approval by the U.S. Congress.

Postwar development of the Austrian economy has made great strides. Compared with conditions before 1938, the economy is on a far sounder basis. Unemployment is within normal limits, currency is stable. Much of this has come about through aid granted by the U.S. to help reconstruct Europe.

What Austria needs to keep on developing its national economy is not outright aid but low-interest loans. Should World Bank and private loans be granted, hydroelectric and atomic power projects rank first on Austria's list. ▲▲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Hampton Roads Bridge-Tunnel Links Virginia Peninsula with Norfolk

Westinghouse Electrical Equipment is Used Throughout

The bridge-tunnel recently opened across Hampton Roads, between Newport News and Norfolk, Virginia, features many "firsts" in engineering and construction. Among the most interesting of these are the specially engineered uses of electrical power for illumination, ventilation and other required services.

Both bridge and land approaches to the new 7,479-foot portal-to-portal tunnel are lighted with Westinghouse OV-20 mercury vapor luminaires, controlled from the central control panel. The interior of the tunnel is lighted with special Westinghouse fluorescent luminaires—employing enough fluorescent tubes to provide a single uninterrupted light line three miles long. Double rows of these fixtures provide high-intensity lighting at the tunnel portals, while the central portion of the tunnel uses a single row of lights on each side. Lighting intensities at both tunnel openings are controlled in relation to the daylight or darkness outside, so no abrupt visual adjustments to varying light conditions are required when entering or leaving tunnel. Special Westinghouse saturable reactors and controls were developed to provide this important lighting technique. The entire length of tunnel is so well illuminated that motorists will be able to switch off their lights while driving through it.

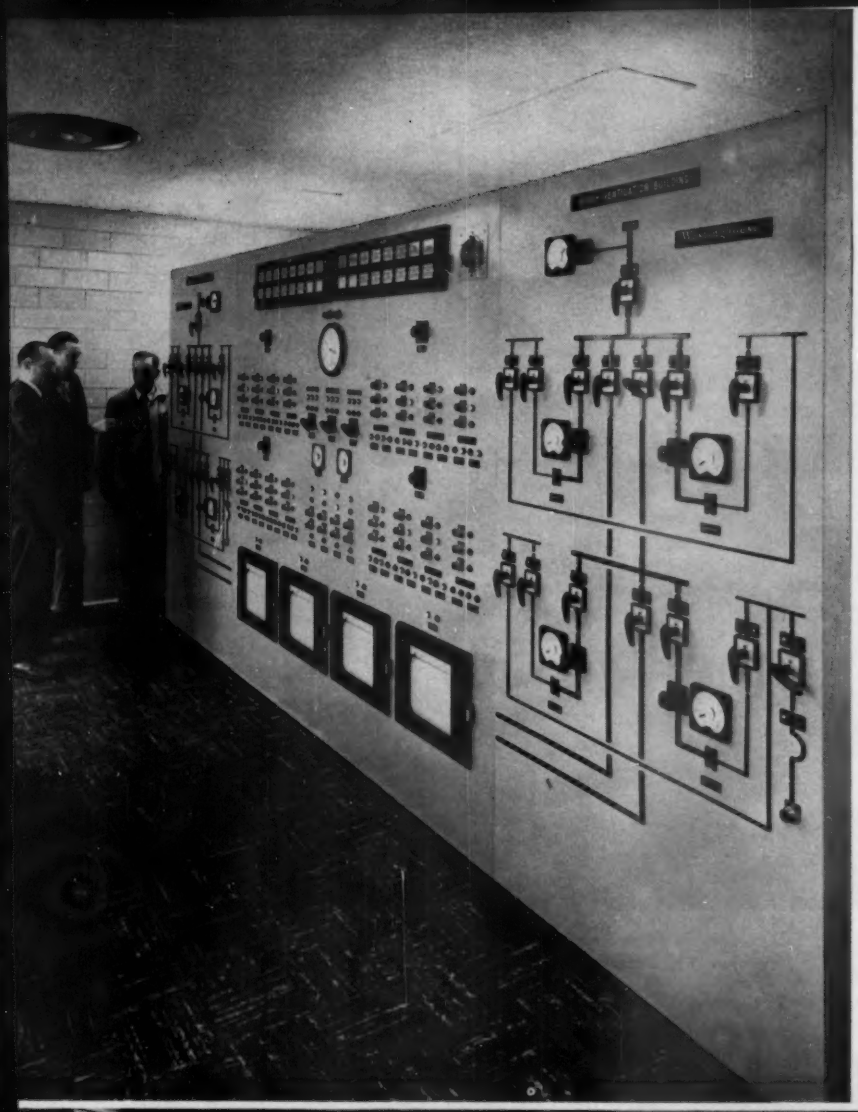
Special Westinghouse equipment controls sixteen vane-axial ventilating fans, eight at each end of tunnel, with a total circulating capacity of 3,408,000 cubic feet of air per minute. Eight fans supply fresh air to tunnel while the other eight exhaust contaminated air. Pitch of fan blades is variable and remotely controlled to permit accurate regulation of air volume handled by each fan. All fan operation is coordinated and controlled at central control board where four carbon monoxide recorders provide a constant check on the concentration of this gas throughout entire length of tunnel.

The entire electrical power requirement of tunnel

(cont'd)

Tunnel is lighted with special Westinghouse fluorescent luminaires installed in protective tubes of pyrex glass. Special bronze fixtures were provided by Westinghouse to mount lights and protective tubes and to facilitate cleaning and replacement.

Intensities of tunnel lighting are varied by means of saturable reactors. Also included in installation are lighting supply transformers and constant current regulators to control bridge and approach lighting. View of transformer room shows John L. Taylor of E. C. Ernst, Inc., Electrical Subcontractors and Engineers, and William G. Phillips, Westinghouse Service Engineer. J-94089-2



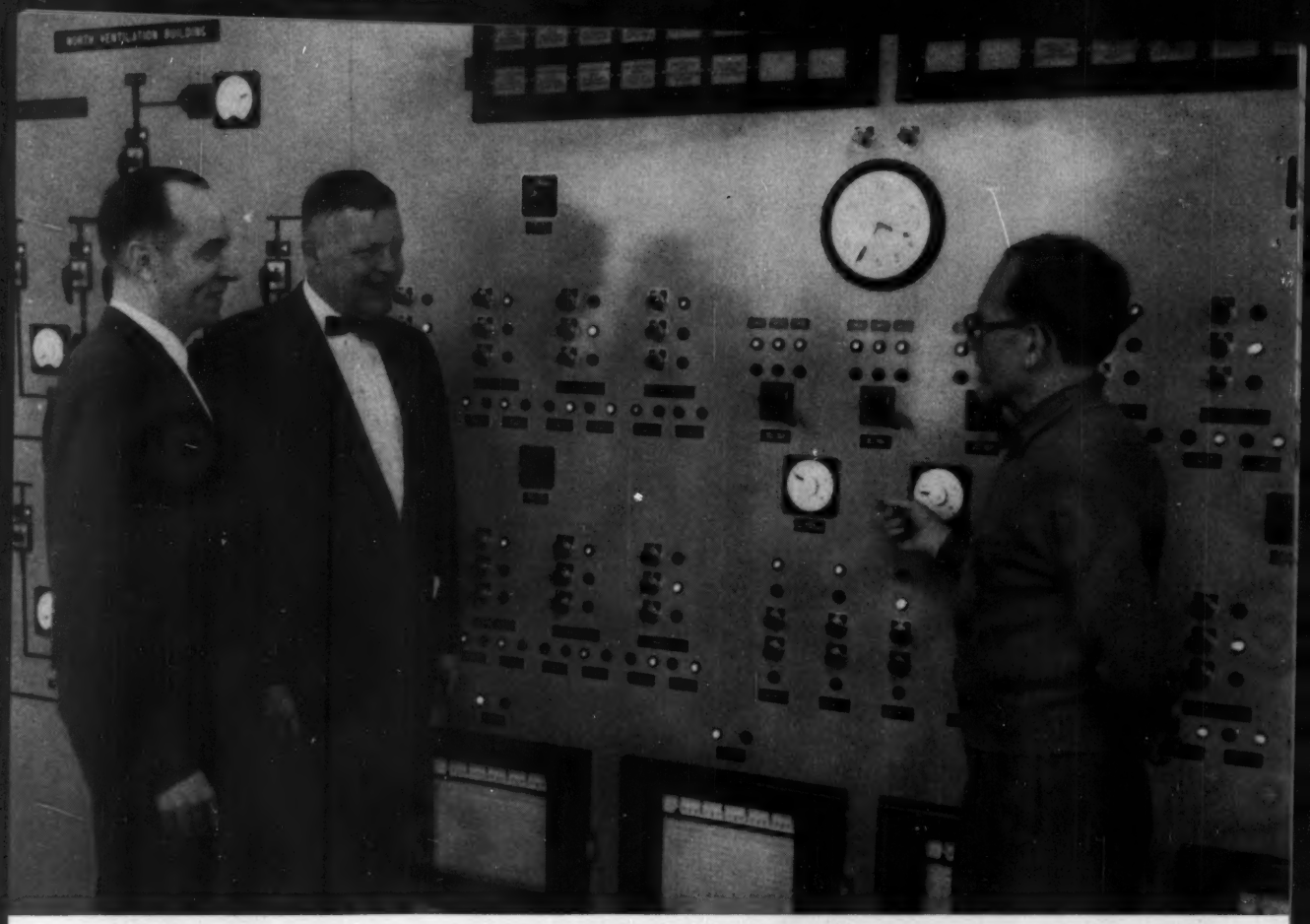
A Westinghouse special master tunnel control board allows operator to supervise tunnel operation from central point. Both tunnel illumination and ventilation are controlled from this board. Ventilating rates can be adjusted by varying number of supply and exhaust fans in operation and by changing fan speed and blade pitch to increase or decrease fan capacities. Also incorporated are alarm indicators, carbon monoxide recorders, time switches and other indicating and control devices. M. B. Trimble, Westinghouse Construction Sales Engineer; James McMahan, Bridge-Tunnel Superintendent, Virginia Department of Highways; and Harry D. Mahoney, Engineer, Parsons, Brinckerhoff, Hall and Macdonald, Consulting Engineers, discuss control board.

Westinghouse double-ended power centers utilize 1000-kva Inerteen®-immersed power transformers. Incoming power service enters metal-clad switchgear located between step-down transformers. Close-coupled to transformer secondaries are low-voltage switchgear assemblies, special fan control cubicles and control centers for tunnel auxiliaries.

J-94089-3

YOU CAN BE SURE...IF IT'S

Westinghouse



Close-up of center of tunnel control board shows M. B. Trimble, Westinghouse Construction Sales Engineer, with Maurice N. Quade and J. O. Bickel of Parsons, Brinckerhoff, Hall and Macdonald, Consulting Engineers, Designers and Supervisors.

is supplied through four identical Westinghouse 2000-kva power centers, two in each ventilation building on man-made islands at each end of tunnel.

This is another example of how Westinghouse can help engineers and contractors satisfy electrical distribution requirements. For information applying to your specific needs, see your Westinghouse electrical construction engineer. Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.

J-94089-4

YOU CAN BE SURE...IF IT'S Westinghouse

Bridge approach to south end of Hampton Roads Tunnel. Illumination for both approaches is provided by Westinghouse OV-20 mercury vapor luminaires controlled by time switches and photoelectric relays.

Owner: Commonwealth of Virginia—Department of Highways

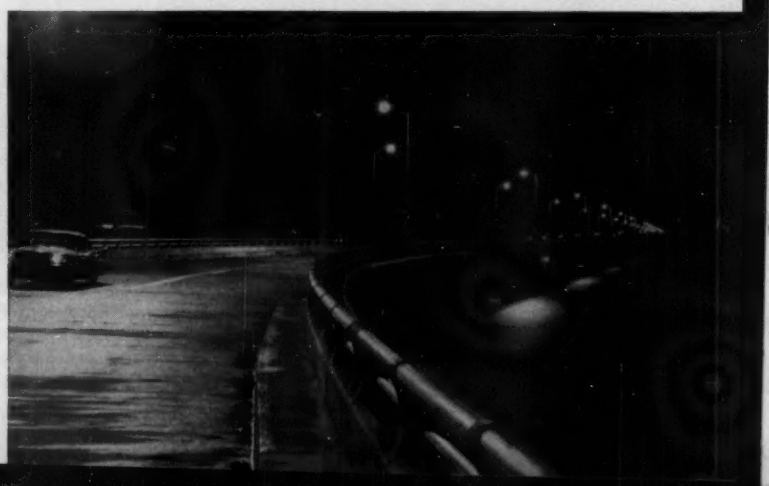
Consulting Engineers: Parsons, Brinckerhoff, Hall and Macdonald

General Contractors: Merritt-Chapman & Scott Corp.
(Approach bridges, portal islands, cut-and-cover sections, underwater tunnel)

Tidewater Construction Corp.
(Portal approaches, ventilation buildings, mechanical and electrical work)

Electrical Subcontractors: E. C. Ernst, Inc.

Over 250 Pages Westinghouse Data in Sweet's Construction File.



Field Notes

MARJORIE ODEN
Eastern Editor

THE GENERAL SERVICES ADMINISTRATION is asking architects to name their consulting engineers at the time of fee negotiations — a major step forward for the consulting engineer in private practice. The GSA adopted this new procedure after a series of meetings between GSA officials and representatives of the Consulting Engineers Council.

Arrangement More Equitable

Under the old system of awarding the GSA contract and letting the architect select a consulting engineer at his leisure, there was a temptation for the architect to choose the consultant who would work for the least money.

Describing this new method as "firm procedure," Fred S. Poorman, GSA deputy commissioner of Public Building Services, amplified the policy: "One practice which has been in effect for several months is the naming of proposed engineering firms by architects at the time of negotiation. When architects are invited for negotiation meetings, we advise them that they should be prepared to name engineering firms they want to use on the proposed project with their qualifications, unless they are organized to use engineers within their own firm. The architects are requested at the time of negotiation to state to whom they intend to award subcontracts for engineering and other related services. We advise them that we will not approve a change in the firm's name without adequate justification. For instance, if it should develop that the workloads of the firms named are such that they could not meet the established schedule for the project, we would permit substituting another firm."

Reporting to the CEC on this meeting with the GSA, John K. M. Pryke, past CEC president and member of the Washington delegation, questioned "whether fees negotiated between architects and their consulting engineers for GSA jobs are satisfactory. While no further cases of low fees have been brought to CEC's attention, it is felt that there has not been any major improvement since we opened our negotiations with GSA early this year."

Poorman feels writing the consulting engineer's fee into the architect contract would be "too complicated." He believes the general level of architect fees is satisfactory, adding that a number of architects working with the GSA had expressed satisfaction with GSA fees.

At the GSA conference Pryke brought up a problem reported by the Texas Association of Consulting Engineers. Architects for a new post office in Helena, Arkansas, working under instructions of the local GSA office, requested competitive bids for site survey services.

Poorman answered that, as far as he knows, the policy for hiring surveyors is handled by local GSA offices and depends entirely upon local practices. Therefore, he suggested, local CEC member associations should take up these problems with the district GSA office involved.

Besides, Poorman pointed out, most new post offices are lease-back deals with local private property owners. The GSA is not handling this program and no Federal agency is retaining professional services directly for the work.

PHA Responsibility Clause

Meeting with Edmund R. Purves, AIA executive director, Pryke mentioned CEC's concern over the following clause in the Public Housing Authority standard contract with architects:

> 38. Responsibility of Architect. — The architect shall apply to the preparation of the plans and specifications the reasonable and proper skills, judgment, and care which are customary and normal to professional architectural practice, and shall be liable to the local authority for damages or losses resulting from failure to apply the above reasonable and proper skills, judgment, and care.

Pryke argued that most architects doing PHA work impose conditions of this contract on the con-

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sulting engineers. Thus the standard PHA contract form is a joint concern of CEC and AIA.

A resolution passed at the San Francisco CEC meeting suggests that the phrase ". . . and shall be liable to the local authority for damages or losses resulting from failure to apply the above reasonable and proper skills, judgment, and care . . ." be eliminated from the contract on projects that do not involve construction supervision. On projects involving construction supervision, the Council resolution asks that an additional sentence be added to the present responsibility clause: "The architect does not, however, guarantee the performance of the construction contract between the contractor and the local authority."

Pryke suggested that the Council resolution would interest members of a joint AIA-PHA committee. He requested an opinion on the proposed clause and a statement of the AIA position for cooperation with CEC on this matter. Purves said he will discuss the matter with the AIA committee which concerns itself with PHA relations and will keep CEC informed.

AIA cooperation was requested on another resolution passed by the CEC San Francisco meeting. The resolution states:

> It shall be considered unethical practice for any member of the Consulting Engineers Council to submit a quotation for engineering services which is solicited by mail, or in any event where he has reason to believe that other engineers are being requested to submit a quotation for the same services.
>
> Elements considered to constitute a quotation include: total fee, fixed fee, percentage fee (other than by reference to an established and recognized fee schedule), manhours, hourly rates, or any combination of such elements. Replies to such solicitations shall be limited to listing technical qualifications and availability.

Pryke requested that this resolu-

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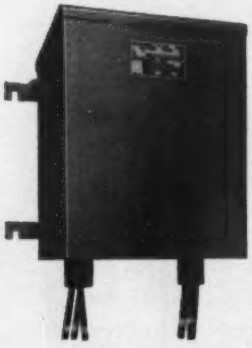

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tion be circulated to all AIA members as soon as practical.

Contractor-Engineer Problems

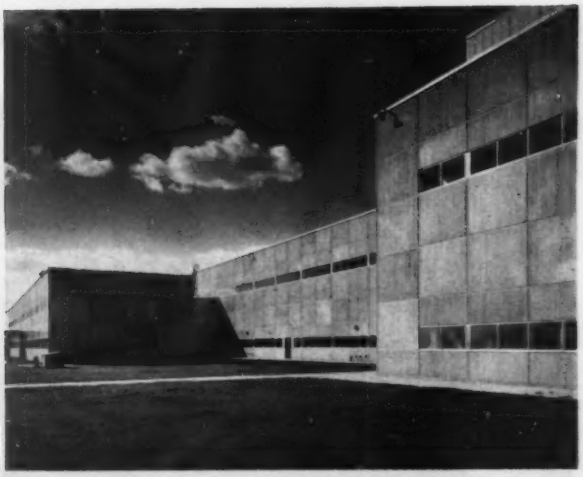
George B. Roscoe, executive secretary of the Council of Mechanical Specialty Contracting Industries, suggested a joint committee be formed with CEC to discuss mutual contractor-consulting engineer problems. Roscoe said he would like to have an official CEC endorsement of the joint committee and suggested the endorsement be accompanied by a list of members appointed. The CMSCI secretary also recommended that the committee be kept small – limited to perhaps four or five from each of the groups.

If the CEC agrees to the proposal, Roscoe thinks it a good idea for CEC to establish a similar joint committee with the Associated General Contractors of America, Inc. Roscoe said this joint committee could be made up of civil engineers, since they are more directly concerned with general contractors than are mechanical and electrical consultants.

Pryke and Roscoe discussed the National Conference on the Construction Industry, scheduled for next April at Rensselaer Polytechnic Institute. A preliminary conference meeting has been called by the U.S. Chamber of Commerce. Just about everybody has been invited to participate – 18 organizations ranging from the American Society of Civil Engineers to the National Paint, Varnish, and Lacquer Association, Inc. But not the Consulting Engineers Council.

Pryke feels "CEC should get in touch with the Chamber of Commerce at once with a view to participation. This matter is extremely urgent and most important from CEC's point of view. I am sure the rest of the executive committee will agree to our participation."

Roscoe mentioned a "Statement of Recommended Ethical Conduct for the Construction Industry," recently compiled by the National



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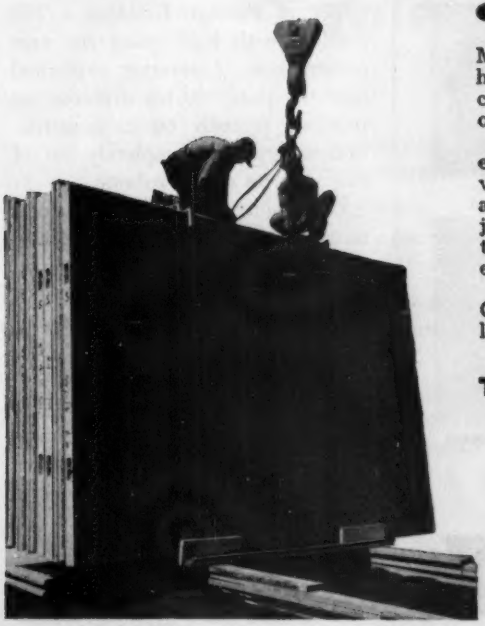

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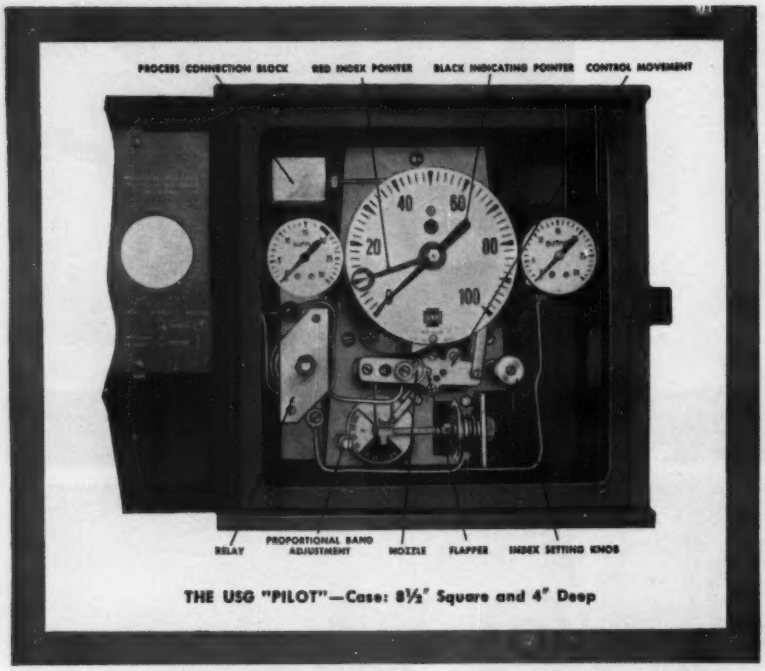

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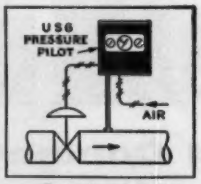

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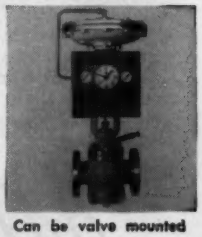

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Joint Cooperative Committee of the Associated General Contractors and Council of Mechanical Sepciality Contracting Industries. The proposed statement was approved unanimously by the CMSCI, and has been referred to the constituent association with recommendations for "expeditious adoption." It also has received official approval from a number of national organizations.

A key clause in the statement:

> Cooperation between construction contractors and the engineering and architectural professions should be carried on locally and nationally to establish clear concepts of functions and responsibilities, to guard against uneconomical and improper practices and carry forward construction activities. In this connection all efforts of these professions to maintain and extend high standards of conduct should be supported. Contractors and the professions should give full credit to the value of each other's services and never disparage the other's function or usefulness.

Roscoe asked that the CEC offically approve the statement.

OFB Activities

Pryke was told by Henry J. Lawrence of the State Department that total annual expenditure of the Office of Foreign Building is $20 million, with half going for new construction. Lawrence explained that the publicity his division has received recently on its construction program is completely out of line with its dollar volume.

OFB policy is to engage architects at AIA standard fees. However, the Office provides its own supervision of construction and, therefore, that portion of the architect's fee is deducted.

OFB is not concerned with selecting consulting engineers. It does, however, approve the engineer's name submitted by architects, and Lawrence asked for a copy of the CEC membership for future checking and reference. ▲▲

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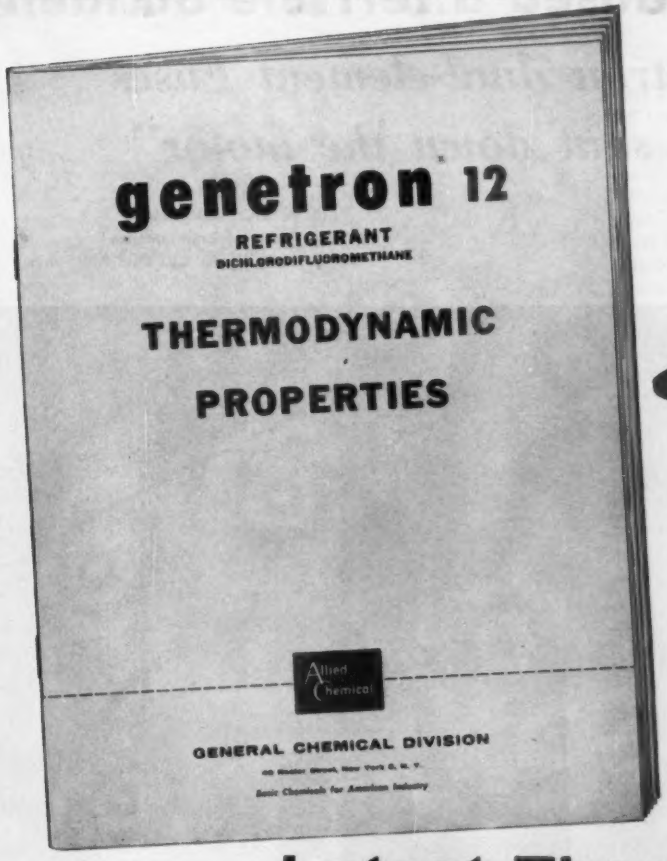

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... *if Fusetron dual-element Fuses had not shut down the motor*"

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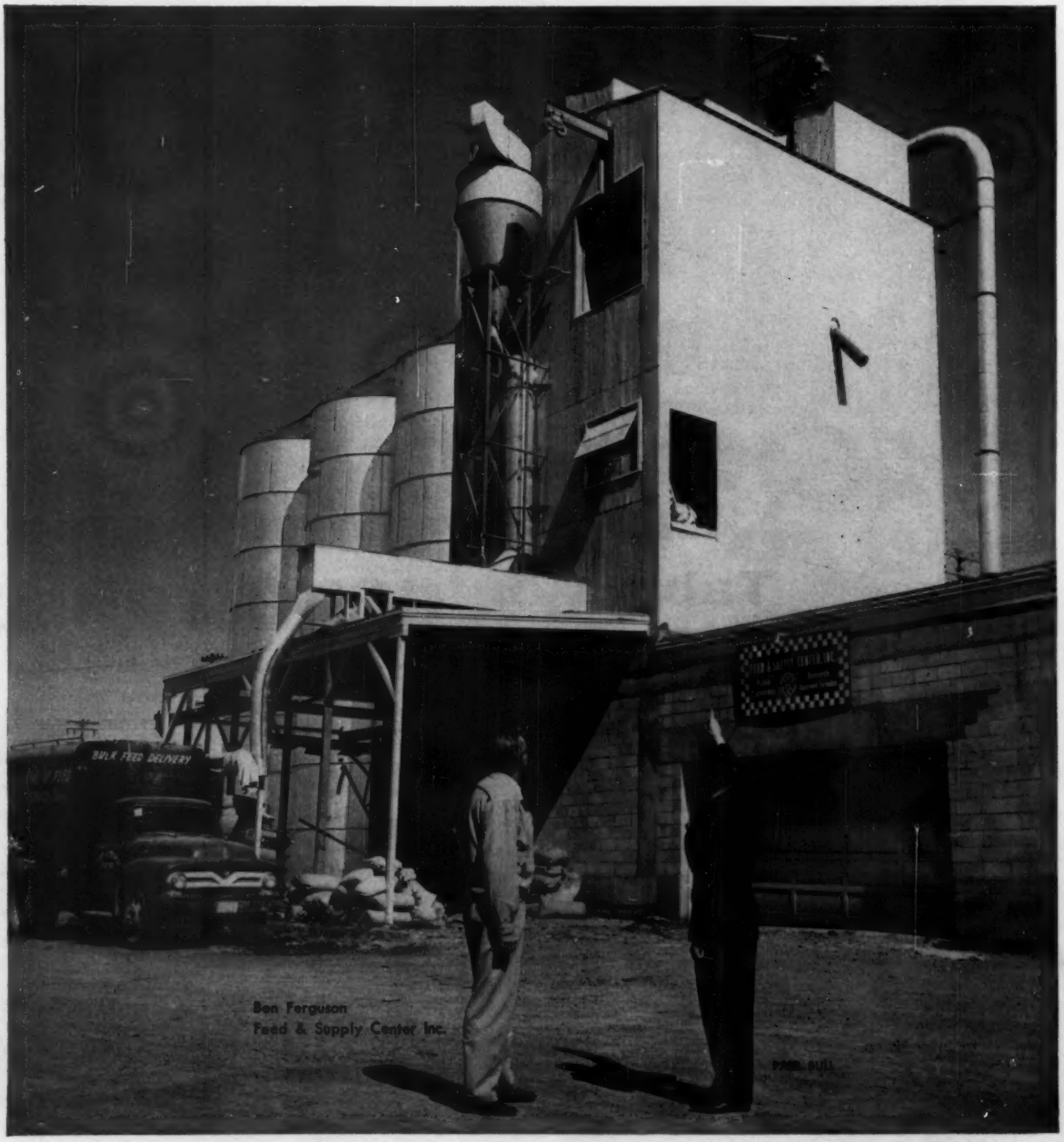

Ben Ferguson
Feed & Supply Center Inc.

Mr. Bull continues:

"As a Commercial and Industrial Representative for the Idaho Power Co., I was asked to redesign the electrical work for the Feed & Supply Center Inc., Twin Falls, Idaho. The installation was handled by Detweiler, an electrical contractor.

"When the job was completed, Fusetron fuses kept blowing on a 15 hp., motor that operates the elevator.

"Larger size Fusetron fuses were tried and the result was almost disastrous.

"When the motor started the whole elevator shaft shook as if it would tear apart. Everyone was afraid that at any second the motor and apparatus would come crashing down the shaft.

"Fortunately, the Fusetron fuses opened and stopped the motor.

"A thorough check revealed that the shaft of the motor was bent in transit.

"If Fusetron fuses had failed to open to protect the motor, there might have been a terrible accident."

You too, can benefit by the 10 point protection of Fusetron fuses.

Fusetron dual-element fuses offer the safest, most complete electrical protection possible. With rare exceptions on commercial and industrial installations — ordinary fuses and circuit breakers protect only against short-circuits — but Fusetron dual-element fuses provide 10 point protection.

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BUSS Hi-Cap fuses offer unlimited interrupting capacity for circuits of 600 volts or less. Their high speed operation on heavy shorts limits current to safe values. This minimizes damage to equipment and cuts down dangerous stresses on transformers.

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Play Safe! specify FUSETRON dual-element FUSES and BUSS Hi-Cap FUSES throughout entire Electrical System!

Beyond Our Borders

Construction in Fiji Islands

The Fiji Islands are in the midst of a substantial construction boom. Projects planned or under way in this British crown colony include airports, docks, roads, schools, and hotels.

¶ A $9-million program will improve the docks at Suva (Fiji's capital) and Lautoka with the plans including new wharves, new slipways, explosive magazines, and dockside buildings, along with demolition of some existing structures.

¶ Suva's busy Nadi airport will get $9 million in new runways and terminal buildings. The islands have become an important stop for Australian and American airlines and transpolar flights. The bigger and faster planes coming into service have made longer runways mandatory.

¶ Four modern hotels have been proposed. One, financed by Canadian business interests, would cost $4.5 million.

¶ A new highway with four bridges has just been surfaced, appropriately, with coral. Tests show coral forms a hard smooth surface, a big improvement over loose gravel.

¶ A recently completed waterworks project cost $500,000 and included three reservoirs and 11 miles of trunk mains.

¶ A million dollars in new schools will be started this fall to replace aging high schools. The new buildings will have big sunny classrooms, laboratories, playing fields, and quarters for the teaching and administrative staff.

Rhodesia Railway Improvements

The Rhodesia Railways, government-owned railroad monopoly in the Federation of Rhodesia and Nyasaland, has just negotiated its second loan in 5 years to improve its system. The first loan, for $14 million made in 1953, went to buy locomotives, cars, and equipment so the railroad could haul more freight. The improvement was dramatic, for in the three years from 1953 to 1956 freight tonnage jumped 50 percent.

But the new money ($25 million) will not go for more rolling stock; instead it will buy more operating efficiency, improved permanent way, and a centralized traffic control system. Reason is that the need for more freight-carrying capacity is slacking off drastically. The Rhodesian economy is tied closely to its chief export – copper – and the price of copper has tumbled in the world markets. As a result, Rhodesia's economy is no longer expanding so rapidly. Instead of more freight cars, the railroad needs more efficiency.

Because the Federation (larger than France, Spain, and Portugal) has no outlet to the sea, it is dependent on the railroad for internal transport and bringing imports and exports to ports in Mozambique, Angola, and the Union of South Africa.

Cold-Storage Plant for Ghana

A cold-storage plant with facilities for bulk storage of meat, fish, and other items on a rental basis is being constructed at Accra, Ghana.

The new plant, which will have a maximum initial capacity of 1500 tons and space for expansion to 3000 tons, is being built by Ghana Industrial Development Corporation, a government entity, and a consortium of three Danish firms and one Norwegian firm. The plant is expected to be completed within 9 months.

A fleet of refrigerator trucks, to be procured by local tender, also will be operated by the company.

Before the end of the year a subsidiary will be organized to produce 1000 gallons of recombined

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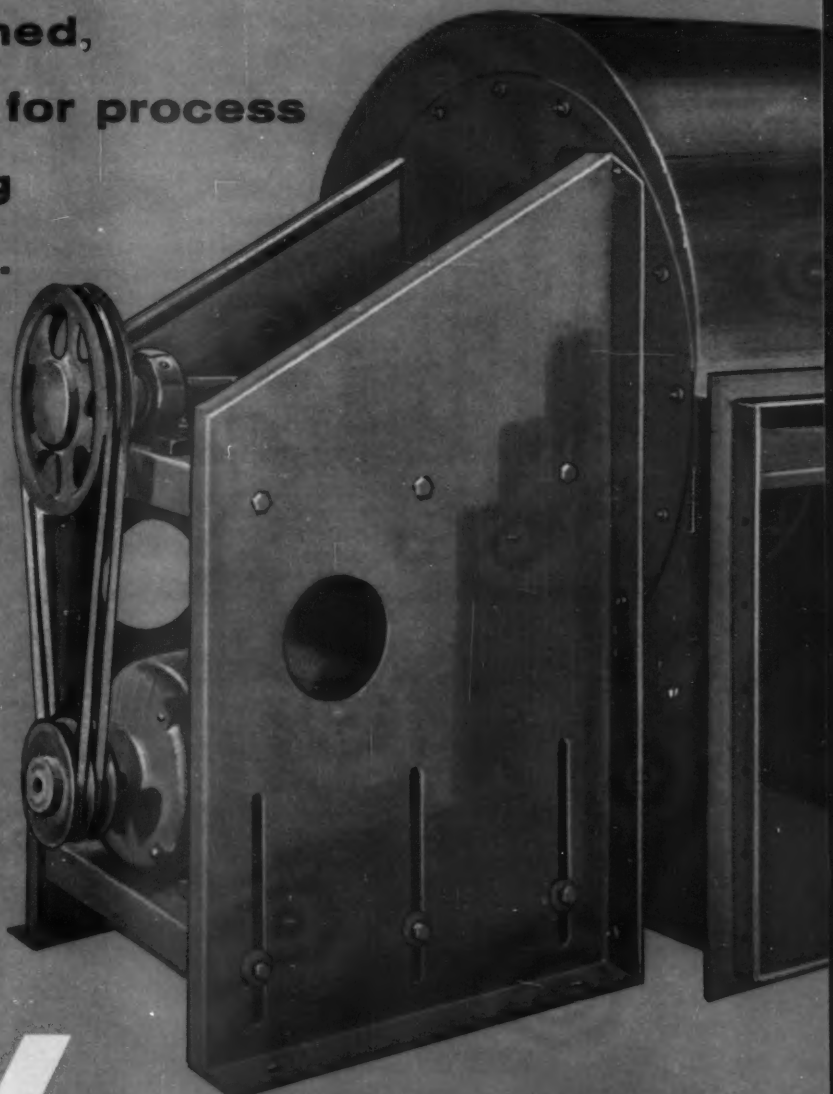
From design through maintenance, present day air handling problems demand BIG performance from fans. And General Purpose Fans do the job, give you that BIG performance. They're made in four types, 12 basic sizes, with capacities from 160 to 19,070 Cfm; in both constant speed units with direct connected motors and adjustable speed units with V-belt drives and integral mounted motors; particularly for use with duct systems. Send for Bulletin 563.



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UNION BONNET GATE VALVES

125 lb.

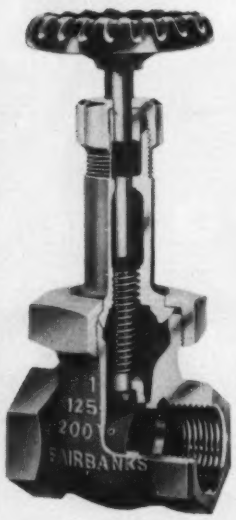

FIGURE U-0252 Rising Stem. Solid Wedge. Taper Seat. 125 Pounds Steam Working Pressure. 200 Pounds Cold Water, Oil or Gas Pressure. Non-Shock.

150 lb.

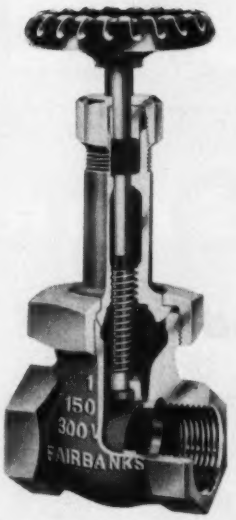

FIGURE U-0226 Rising Stem. Solid Wedge. Taper Seat. 150 Pounds Steam Working Pressure. 300 Pounds Cold Water, Oil or Gas Pressure. Non-Shock.

Two-Piece Union Bonnet Construction For Extra Easy Assembly And Disassembly

Two-piece **Radial Seat** Union Bonnet Construction provides extra easy assembly, long service, dependability that gives you extra value. **Radial Seat** provides line contact through accurately machined true ball and socket mating surfaces, for leakproof body bonnet joint. Two-piece construction eliminates sliding or scraping — prevents scoring — of body and bonnet mating surfaces during assembly and insures even contact pressure for perfect alignment of working parts. Heavy union nut will not deform under pressure and protects body and bonnet from distortion. Valves may be repacked under pressure when wide open—top seat above threads—out of line of flow—is protected against deposits and excessive wear.

SERVICE: Recommended for general service on steam, water, gas, and oil lines where full, unrestricted flow is desired. Valves give long trouble-free operation.

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milk daily, as well as canned, evaporated, and unsweetened milk, and processed cheese, using the facilities of this cold-storage plant.

The Scandinavian group is conducting a preliminary survey aimed at possible construction of similar plants at Tema, Kumasi, Takoradi, and Tamale, but investment in those areas is not expected until the outcome of the Accra operation is determined.

Power of Hydrogen

Russian scientists are storing wind energy by converting it into hydrogen by the electrolysis of water, an idea originally advanced some 40 years ago by Russian inventor Aleksandr Ufimtsev. A power station in the Alma-Ata steppes near Lake Balkhash consists of a 25-kw windmill, an electrolytic device, and an internal combustion engine adapted to operate on hydrogen fuel. Wind velocity of 40 miles an hour produces, by electrolysis, 700,000 cubic feet of hydrogen annually. This hydrogen will generate 20,000 kwh of electricity in still weather. The efficiency of the process is about 30 percent, but it may be raised to nearly 60 percent.

Hospital Plan

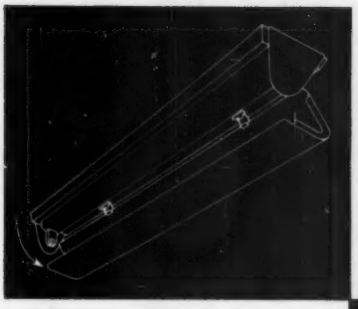
Construction spending for new hospitals in Britain will run about $60 million this year, more than double the amount spent 3 years ago. And next year this expenditure will be boosted another 10 percent.

In addition to new buildings, many old hospitals have been improved and extended. As a result the total number of staffed beds has risen from 448,000 to 474,500.

Pakistani Irrigation Project

So far $13-million has been spent on the Guddu Barrage which, on completion, will irrigate 2.3-million acres of Pakistani land.

A protective ring bund at the headworks has been strengthened and further extended. The power house building has been completed



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Reliance
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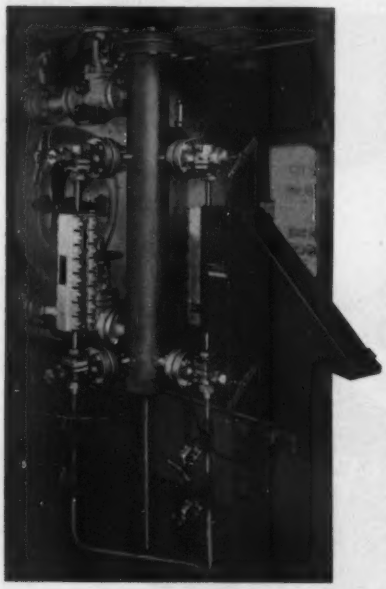
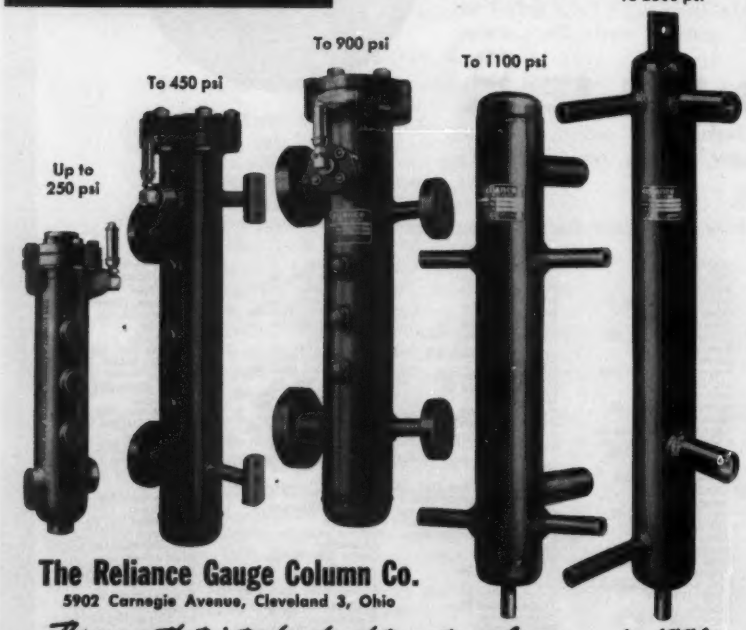


Water columns have been around for a long time — ever since Reliance introduced the first one in 1884. Its chief reason for existence then was to carry the float-operated whistle alarm and mechanism, to warn operators of dangerously low water in the boiler. Since then, the water column has been developed in various styles and capacities to meet any power plant need. They are used on most boilers today as an accepted necessity, although many old time engineers — and thousands of young ones — can't explain their full usefulness. If you'd like to know "why a water column", write for free copy of our Liquid Level Letter No. 11.

Reliance makes Water Columns in seven pressure categories, five of which are represented below. And complete "trim" — gage cocks, gage valves, gage inserts, special gages and direct-to-drum assemblies. Write for information on equipment suited to your working pressure.



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The name that introduced safety water columns....in 1884

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with 375-kw generating sets. The main Sind Begari feeder, completed last year, was further extended through the Ghouspur loop.

A cross-regulator has been constructed on the left bank of the Ghotki feeder above the offtake of Lundiwah. Another has been added at the 60th milepost of the Begari canal.

A broad-gage railway has been extended to the headwork site so stone rakes coming in from Kashmore can be taken directly to the site. A narrow-gage line to the quarry also has been completed and train service has started from quarry to the site.

AEC Research Grants

The AEC has announced money and equipment grants to nine nations for construction of nuclear research reactors to be used in study and education projects. The individual projects are:

¶ For Austria a 5-Mw tank-type reactor, convertible to 12 Mw; it will be a light-water cooled and moderated, heterogeneous, solid fuel research reactor, designed, engineered, and manufactured by AMF Atomics, Incorporated of New York, a subsidiary of American Machine and Foundry Company. Site construction will be handled by Austrian contractors, aided by AMF Atomics field engineers who also will assist in equipment installation, testing, and reactor start-up.

The machine will be part of a $4-million nuclear center near Vienna which will include a 5.5-MEV Van de Graaff accelerator, with separate laboratories for chemistry and metallurgy; physics and electronics; biology, agriculture, and forestry.

¶ For China a 1-Mw (heat) heterogeneous light-water cooled and moderated pool-type reactor designed and built by International General Electric. IGE also will fabricate fuel elements from uranium leased by the U.S.

In addition to the reactor, the $900,000 project includes a reactor physics laboratory, a radio-chemical

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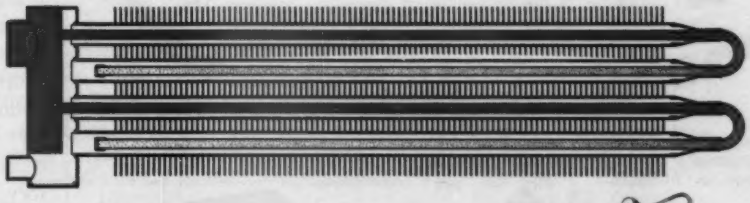
PUTS A "U" TURN

in the steam-distributing tube to provide

The unique "U" turn in the design of Series T Surface with TROMBONE steam distributing tubes doubles the surface area over which steam quantities are distributed. This achieves a uniformity of steam distribution unmatched by conventional arrangements. Because the exclusive Nesbitt TROMBONE construction results in only one half the normal number of connections to a supply header, the quantity of steam supplied to the first leg of each TROMBONE distributing tube is double what it would be in a conventional design. This higher rate of steam per distributing tube is particularly important when a small steam quantity is being supplied. The same quantity of steam will travel twice as far along the surface length and contact twice the surface area.

Net results: Uniform discharge temperatures and *maximum* freeze protection over the entire capacity range—from 100% down to the smallest practicable supply of low pressure steam under valve control.

Nesbitt Trombone Surface:
Note how the steam is apportioned to every other tube. The same steam quantity goes twice as far in each tube. Even small steam quantities are distributed over the full surface length. Results: uniform final temperatures, full length of coil; freeze protection; perfect control with modulating valves.



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We provide not only wiring plans, shop drawings, specifications and costs, but with our nation-wide organization of exclusive distributors we also give your clients on-premise maintenance of equipment and instruct their personnel in its proper use. If you have a job on your boards that should utilize intercom or sound, you should be familiar with these four important Executone services:

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Executone's Field Engineers will assist you in determining your clients' communication needs... recommend the system designed for the job... provide you with a professional consultation service.

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Each local Executone distributor is prepared to take full responsibility for the final and satisfactory operation of the system, whether installed by the contractor, or his own factory-trained crew.

But also this!

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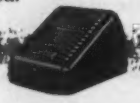
Each local distributor is staffed with skilled, factory-trained technicians. They also have complete stocks of standard replacement parts. Continuous, uninterrupted performance of every Executone system is assured.



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laboratory, a hot cell and isotopes-handling laboratory, classrooms, repair shops, and offices, all to be built at the Institute of Nuclear Science near Taipei, Formosa.

¶ For Belgium a 50-Mw light-water cooled and moderated, pressurized, tank-type reactor for materials testing and educational training.

The reactor was designed by the Nuclear Development Corporation of America of White Plains, New York and is being constructed in Belgium under the guidance of the Bureau d'Etudes Nucleaires.

The $10-million project will include, besides the reactor, gamma irradiation facilities, hot cells, shops, laboratories, and offices.

¶ For Israel a 1-Mw heterogeneous pool-type reactor manufactured, assembled, and installed by AMF Atomics, Inc.

A $1.4-million nuclear center will include a radio-chemical laboratory for nuclear research and isotope separation; a physics and electronics laboratory; machine shops; and health physics and disposal services.

¶ For Italy a CP-5 reactor to be installed in the Italian Center of Nuclear Research at Ispra.

In addition, the Italian Comitato Nazionale per le Ricerche Nucleari has received a cobalt 60 gamma irradiation unit for research on radiation effects on agricultural crops. The research center will be set up at the University of Pisa botanical institute.

¶ For Greece a nuclear engineering laboratory at the new Democritus nuclear center near Athens. The laboratory includes a subcritical assembly, 2500 kilograms of canned uranium slugs as fuel for the assembly, a 250-milligram radium-berrylium neutron and gamma ray source, neutron and gamma ray counters, and flux mapping parts.

¶ For Uruguay a biochemical laboratory, medical diagnostic laboratory, and a cobalt 60 teletherapy laboratory installed at the University of the Republic, Montivideo.

¶ For Norway a zero-power pool-type facility fueled with natural

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In larger sizes, *Silco-Flex* insulation is used. In this system, silicone rubber is vulcanized into a homogeneous mass to form a flexible, moisture and heat resistant, void-free dielectric barrier around coils and leads.

Both of these insulation systems are unsurpassed. Proof? An encapsulated motor ran for hundreds of hours at full load in a 4% brine solution.

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uranium, moderated and cooled with heavy or light water. Reactor construction will be handled by the Institutt of Atomenergi (an agency designated by the Norwegian government for nuclear research and development) or by Norse firms.

A reactor school, established by a joint Netherlands-Norway research organization, will use the facility to train Dutch and Norwegian students in nuclear science and engineering. The reactor will be available to graduate physics students at the Technical University, Trondheim.

¶ For Puerto Rico a 1-mw (heat) forced circulation pool-type reactor at a research center near the University of Puerto Rico. Designed as a training and research facility, the reactor will include a thermal column with both horizontal and vertical access, six experimental beam holes, and a dry gamma irradiation facility.

Swiss Telephones

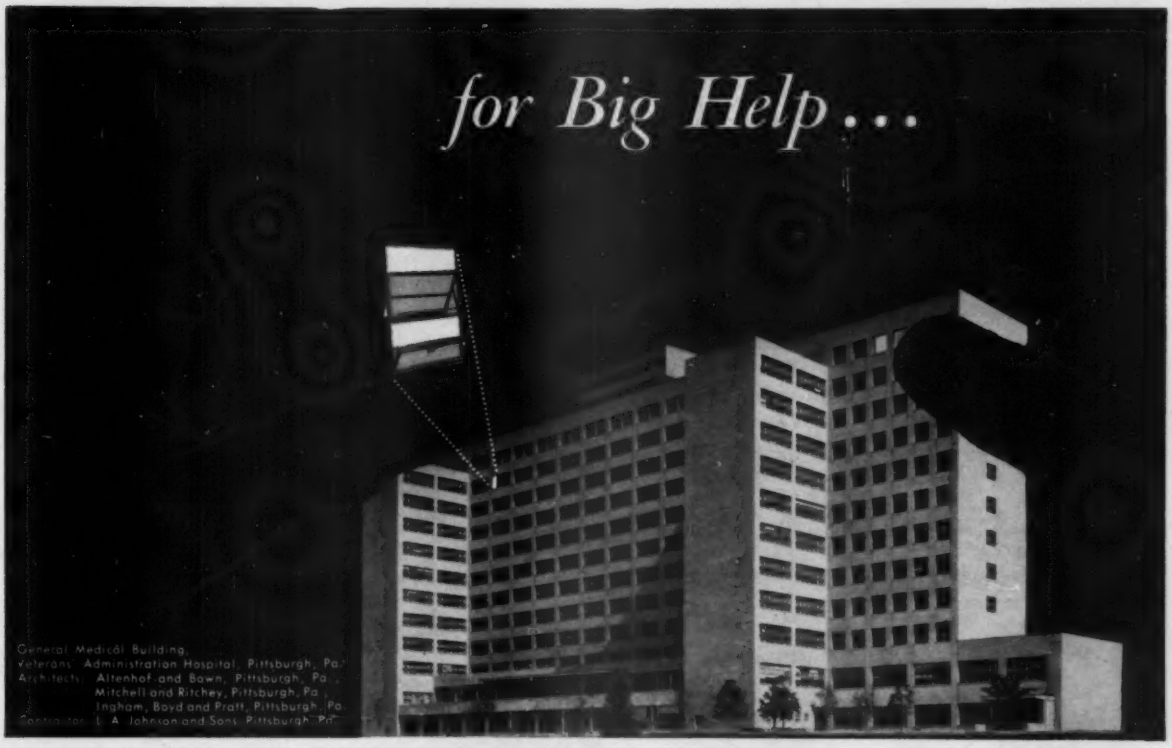
Switzerland is constructing a series of new transmitting and relay stations for expanding telecommunications coverage. The first station, on Saentis mountain 2300 feet above sea level, is in service.

Telephone microwave transmission from the station will guarantee connections between Geneva and Lake Constance and greatly improve Switzerland-Germany-Austria connections.

The Saentis installation will complement the relay station at Chasseral, Jura in placing calls to automobiles. Telephones are not placed in vehicles in Switzerland; instead, the driver is signaled by a light and bell on the dashboard to stop and call home or office.

India Refinery

A group of India government officials will visit Rumania soon to begin negotiations for an oil refinery in India. Rumania has offered to construct the refinery, which will be India's fifth, and to supply necessary machinery and personnel on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Mitchell and Ritchey, Pittsburgh, Pa.;
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When is "right from the start"? It is, *when you first consider the part windows and curtain walls are going to play in your building plans.*

Bayley offers *pre-engineered* wall treatments that let *your* plans range from conservatively modern to strikingly different.

Backed by years of highly effective co-operation with architects and engineers, Bayley's development of many of today's most advanced curtain-wall systems and improvements began *over 30 years ago.* And, *for three quarters of a century,* Bayley has been strengthening its reputation for responsibility you can count on, from initial planning to occupied building.

The *earlier* you put Bayley's *extra services* to work for you, the more certain you are of getting *what* you want in the way of a wall that is soundly built, permanent, *and lastingly beautiful.* Call your local Bayley representative any time.

See Sweet's Files (Architectural or Industrial Construction) or send for personal copies of the following Bayley catalogs: **Aluminum Windows, Steel Windows and Doors, Curtain Wall Systems, Guard Window Detention Systems.**

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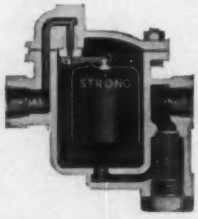
LESS WEAR . . . only two parts move — no pins on larger traps
INTERCHANGEABLE INTERNAL PARTS . . . made of tough stainless steel

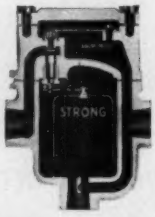
STRONG'S complete line contains a trap for every steam system: 0 to 2500 psi, 0 to 1100°F, 0 to 100,000 lbs/hour.

Horizontal, in-line traps:

140, 141, 142, 143, 144 (semi-steel): pressure-temperature limit — 250 psi at 450°F; capacities to 11,500 lbs/hour



140S, 141S, 142S (semi-steel): same as 140-142, with a built-in strainer for removing foreign matter.



140T, 141T, 142T (semi-steel): same as 140-142, with a high capacity thermal vent for faster heating

Bottom inlet, top outlet traps:

42, 43, 44, 45, 46 (semi-steel): pressure-temperature limit — 250 psi at 450°F; capacities to 42,800 lbs/hour

643, 644, 645, 646 (cast steel): pressure-temperature limit — 600 psi at 800°F; capacities to 42,800 lbs/hour

1543, 1544, 1545, 1546 (forged SAE 4130 Chrome-Moly Steel): pressure-temperature limit — 1500 psi at 950°F; capacities to 42,800 lbs/hour

642 (forged steel): pressure-temperature limit — 400 psi at 850°F; capacities to 2665 lbs/hour (not illustrated)

2544, 2545, 2546 (forged ASTM A335-P22 Chrome-Moly Steel): pressure-temperature limit — 2500 psi at 1100°F; capacities to 42,800 lbs/hour (not illustrated)

For complete information and prompt service, call your local STRONG distributor.

STRONG, CARLISLE & HAMMOND

508 Sandusky Street • Conneaut, Ohio

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air traps • strainers • vacuum or pumping traps
continuous blowdown valves • separators • engine stops • F and T traps • reducing valves

a long-term credit basis. This assistance will be repaid by certain Indian commodities, principally jute manufactures, mica, and other mineral ores.

The refinery will be erected in Guahati (Assam state) to handle oil discovered recently in the area. The refinery is expected to have a capacity of between 750,000 and 1 million tons a year. Estimated cost will be $31.5 million, of which approximately $19 million represents Rumanian credits.

Power Project in Mexico

Mexico plans four large power projects to provide additional electricity for Mexico City, Guadalajara, Puebla, Veracruz, and Sonora.

The projects, part of the Federal Electricity Commission's $250-million 5-year expansion program, are the Mazatepec 156,000-kw hydroelectric plant on the Apulco River in Puebla; the Temaxcal 154,000-kw hydroelectric plant on the Tonto River southwest of Veracruz; the Cupatitzio 73,600-kw hydroelectric plant on the Cupatitzio River in Michoacan; and addition of a 30,000-kw generator to the 25,000-kw Sonora plant.

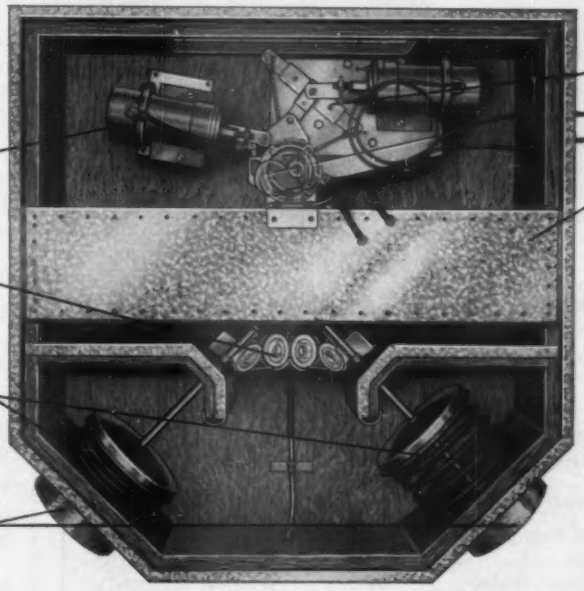
The four new power plants will bring additional power to rapidly developing industrial and agricultural areas, now restricted in electricity use with no reserve capacity.

Foreign exchange costs are financed by a $34-million World Bank loan made jointly to the Federal Electricity Commission and Nacional Financiera, S.A. The Commission is an autonomous agency of the government and owns and operates power plants producing one-third of Mexico's electric power supply. Nacional Financiera is the official financing institution, by law the sole agency for negotiation and administration of external loans on behalf of the Mexican Government.

The rapid expansion of the Mexican economy in postwar years depends on electric power expansion. In 1952 power plants of the Com-

7 ENGINEERING REASONS *Why*

TO SPECIFY *NEW* CONNOR KNO-DRAFT HIGH VELOCITY VALVE ATTENUATORS


1 CONSTANT VOLUME CONTROL
2 HIGH QUALITY COMPONENTS
3 PATENTED HELICAL NEOPRENE SPRING DAMPERS
4 45° INLETS
5 UNITIZED LINKAGE MECHANISM
6 CHOICE OF SOUND BAFFLES
7 MODELS FOR EVERY REQUIREMENT

SHOWN HERE are seven sound reasons why new Kno-draft "Series 45" Valve Attenuators meet every test of high velocity systems . . . assuring better balanced air delivery and constantly controlled air diffusion.

CONSTANT VOLUME CONTROL insures constant air volume despite static air fluctuations. Single adjustment of pressure regulator balances total air volume. All constant volume units use standard components of control manufacturers actuated by 15 psi air pressure.

HIGH QUALITY COMPONENTS: galvanized steel casing, vinyl coated acoustical absorbing material, nylon pulleys, stainless steel aircraft type cable.

PATENTED HELICAL NEOPRENE SPRING DAMPER positively assures complete close-off . . . full heating and cooling realized because damper shuts with less than 2% leakage.

45° INLETS mean fewer elbows required in take-off ducts, reducing static pressure losses and installation costs.

UNITIZED LINKAGE MECHANISM reduces friction, eliminates control lag, insures precise temperature regulation, permits easy servicing.

CHOICE OF SOUND BAFFLES: internal flat plate for quiet operation; patented sinuous baffle for use when maximum sound attenuation is demanded.

MODELS FOR EVERY REQUIREMENT: Open End, Diffuser, Integral Grille, Linear Diffuser, Under-Window.

The outstanding performance of the "Series 45" can only be matched by using its features.

CONNOR... for Constant Comfort Conditions

Request New 24 Page Bulletin K-33-A For Complete Information on All High Velocity Systems

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kno·draft®

high velocity air diffusers

LUMI-POST

A NEW IDEA IN

OUTDOOR LIGHTING

that is

MULTI-PURPOSE

and

VANDAL PROOF

Here's a unit that defies vandalism due to its shatter-resistant Plexiglas diffuser. Attractively and functionally designed to withstand the wear of outdoor use, and to provide choice of Silvered Bowl Incandescent, Mercury Vapor or Circline fluorescent light sources for correct light output for most every need.

In addition to uses shown, LUMI-POST is ideal for gardens, entrances, park paths, patios, gas stations, etc.

Note these plus features

- Lighter in weight than glass units
- Easiest to service
- Weather and insect sealed
- Illuminates large area

For complete details send for Bulletin S158

582

SILVRAY LIGHTING, INC.

BOUND BROOK, NEW JERSEY

mission had a total capacity of 286,000 kw. By 1957 this had jumped to 844,000 kw. By 1962 it intends to add about 770,000 kw of generating capacity.

Electric power generated by the Commission, whether distributed by private companies or directly to consumers by the Commission itself, has played a decisive part in the development of Mexico. In Mexico City for example, where peak load in 1958 will be almost 900,000 kw, distribution is handled by the Mexican Light & Power Company. Here the Commission supplies 30 percent of the power. Power from Commission's plants has helped increase Mexican agricultural production in the past few years, by powering pumps used to irrigate arid lands and for new crop-processing plants.

Brazil Bridge

A new bridge, reportedly the largest in South America, will span the Parana River between Sao Paulo and Mato Grosso in Brazil. Part of the national road plan of Brazil, the bridge will be over 1½-miles long and approximately 27 ft wide. Costing $33 million, it will be finished in about 4 years.

African Railway

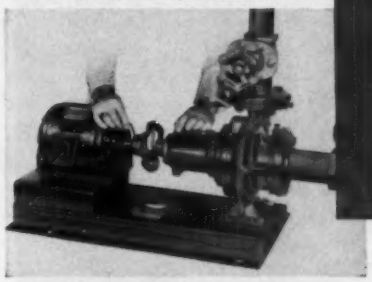
Development of the South-West African railway system—owned and operated by the Union of South African Railways and Harbors Administration and considered an integral part of the Union system — includes broadening some 350 miles of narrow-gage lines.

The work, begun about the middle of last year under an agreement between the Union of South Africa and South-West Africa governments, is expected to be completed by 1961 at an estimated cost of $22.6 million. The government guarantees the railway against annual working losses.

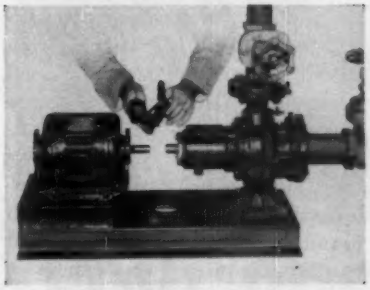
Among the many advantages of broadening the narrow-gage railway are faster transit for goods and passengers; savings in native labor;

EASY TO SERVICE
... no pipes to disconnect

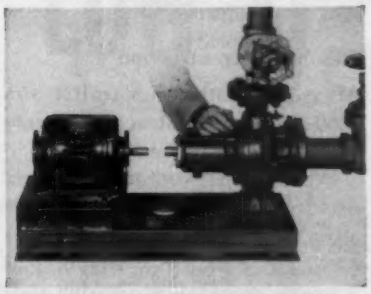
Remove coupler shield



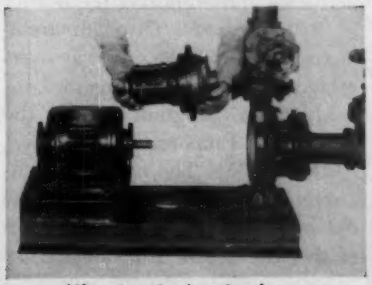
Loosen coupler set screws



Slide coupler off the shafts



Remove volute cover cap screws



Lift out entire bearing frame and impeller

B & G UNIVERSAL PUMP
...featuring vertical split case design

DESIGNED FOR
WHISPER-QUIET
VIBRATIONLESS OPERATION

No feature is so important in a circulated water heating or cooling system pump as *quiet operation!* Transmission of pump noise through the piping can ruin the most carefully installed system.

B&G Universal Pumps meet this challenge. They are engineered and built to satisfy in every detail the exacting demands of circulated water heating and cooling systems...distinguished by numerous features which assure silent, vibrationless operation.

Universal Pump motors, for example, are specially constructed and selected for *extra-quiet* operation. Long *sleeve* bearings are used in both motor and pump—another assurance of silent, vibrationless operation and long life of both pump and motor. The oversized shaft is made of special alloy steel, with an integral, heat-treated thrust collar to absorb end-thrust. Water leakage is prevented by the diamond-hard "Remite" mechanical seal...a B&G development.

Note, too, how *vertical* split case construction with removable bearing frame permits easy servicing without breaking pipe connections.

"PD" BOOSTER
Largest in-line Booster

B&G BOOSTER

B&G Booster pumps are in-line units with the same features which distinguish the Universal Pump. *Nearly 3,000,000 have been installed!*

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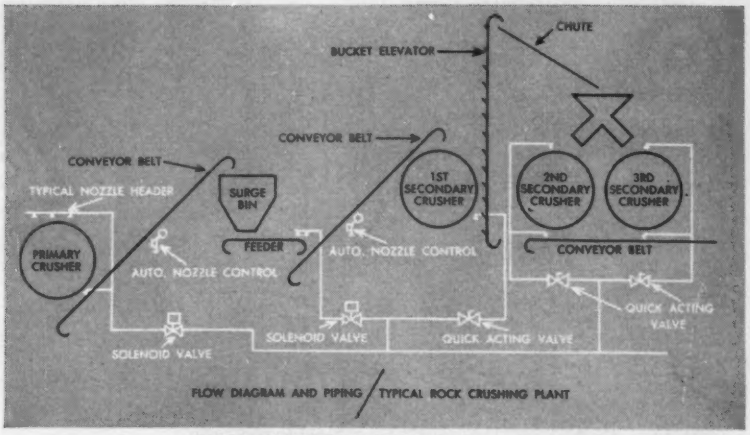
JOHNSON MARCH chem-jet DUST CONTROL SYSTEM



DUST PROBLEM SOLVED economically at typical rock crushing plant. Drawing shows location of Chem-jet applications after system was engineered by Johnson-March.

NOW YOU CAN AFFORD DUST CONTROL

At a fraction of the cost of other methods, Chem-jet brings you efficient, practical dust protection. Chem-jet solves your dust problem by attacking dust at its source. It is the only system of its kind that effectively *prevents* dust from becoming airborne.

- **Low-Cost Dust Control—**

  No other system compares to Chem-jet for low first cost, low operation and maintenance.

- **Each Installation Engineered—**

  To solve each specific dust problem, Chem-jet systems are specially engineered to meet all requirements.

- **Effective Dust Control—**

  Carries through from crushers to stock pile without affecting screens.

Engineering analysis of your dust problem will be made at no obligation. Johnson-March Corporation, 1724 Chestnut Street, Philadelphia 3, Pa.

JOHNSON MARCH DUST CONTROL ENGINEERS

elimination of losses (estimated at $100,000 annually) suffered by farmers from spoilage and damage to livestock; saving 35 cents a ton for shippers by eliminating transshipment at the junction with the broad-gage network; and saving $1.05 a ton on coal loaded onto narrow-gage cars.

When the work is finished the entire South-West system will be broad gage. No immediate plans to extend the rail lines in South-West Africa are proposed, but some improvements, such as a diesel workshop at Windhoek, are planned.

One of the principal drawbacks to the development of South-West Africa is lack of good roads. Though hard surfaced, they are in poor repair. A reason for the backward road conditions is the dominance of the railways.

In 1930 measures were introduced to protect South Africa Railways from road-haulage competition and to give it a monopoly on long-distance hauling. In 1957 road transportation in South-West Africa covered only 4000 miles.

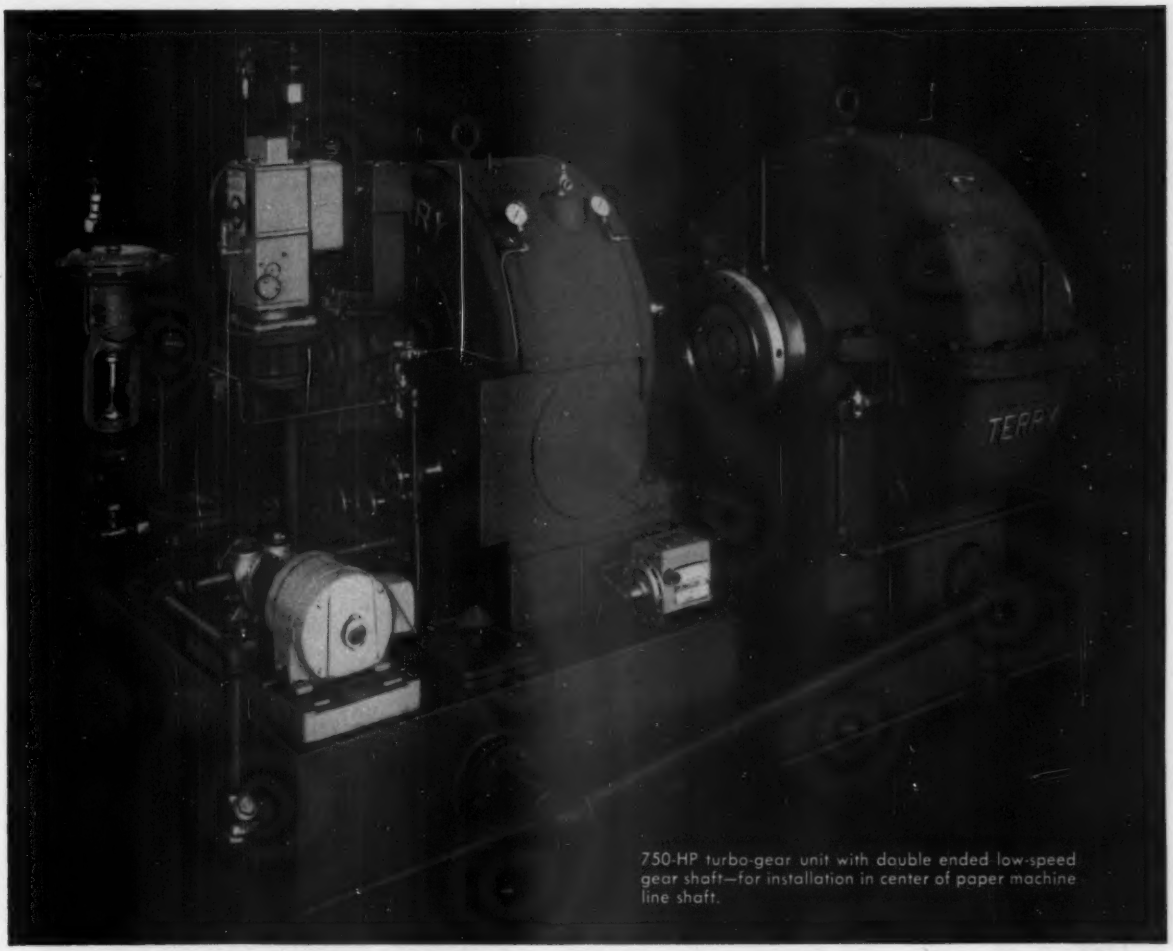
Shortage of rail facilities, however, has necessitated some shipments by private road haulage with permission of the railways. Road haulage has proved very expensive because the trucks, under their permit, must return empty.

Istanbul Reconstruction

After 18 months the ambitious $350-million reconstruction scheme for Istanbul, Turkey is moving.

When Prime Minister Menderes decided to make the city a tourist attraction, bold action was necessary. For centuries building had gone on haphazardly, choking traffic routes and obscuring the beauty of Byzantine and Ottoman architecture. By 1950 the city was overcrowded and traffic congested.

Menderes' program follows the pattern of Emperor Justinian I (AD 483-565). The new roads encircling the historic walls of the old town amount to a restoration of the Mese, which in 6th-century



750-HP turbo-gear unit with double ended low-speed gear shaft—for installation in center of paper machine line shaft.

LOW-SPEED TURBINE DRIVES

tailored to meet your requirements

For more than half a century, Terry has been one of the principal suppliers of turbo-gear units for driving slow-speed fans, generators, paper machines, large pumps and the like. Each unit is designed to meet the job requirements. The paper-machine drive illustrated is a good example of this ***individualized engineering.***

In service at a large southeastern paper mill, the unit delivers 750 HP at 3350/500 RPM, with steam conditions of 450 lbs., 660°F and 50 lbs. back pressure. Equipped with a variable-speed governor, operated by remote control, the speed of the unit may be varied through a 10:1 range. Other features include forced-feed lubrication to turbine and gear bearings, and automatic shutdown and alarm in case of low oil pressure.

Whatever ***your*** requirements for low-speed turbine drives, a Terry engineer will be pleased to discuss them with you. Bulletin S-140 covers the full line of Terry turbines; Terry gears are described in bulletin S-130.

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TERRY

TT-1212

Newest in

distributors by

The new "GARD" rotary distributor has revolutionized trickling filter operation and maintenance.

- ✔ "SEAL-LESS" DESIGN
- ✔ "NON-CLOG" ALUMINUM REACTORS
- ✔ ALUMINUM ARMS
- ✔ OIL SEALED BEARING
- ✔ LOW OPERATING HEAD
- ✔ ADAPTABLE TO ANY PRESENT TRICKLING FILTER

The maintenance of the "GARD" distributor has proven to be negligible and the problem of clogged nozzles is completely eliminated.

Data and specifications available on request.

GENERAL FILTER CO.

WATER PROCESS ENGINEERS

P.O. BOX 350 AMES, IOWA

Byzantium was the main avenue culminating in the Hippodrome.

One of the first projects is a road around Seraglio point and along the west banks of the Golden Horn.

The picturesque city walls, stretching from the Golden Horn to the Sea of Marmara around Seraglio point, are to be rebuilt. Originally built by Theodosius II and reinforced in the 10th century, they have since been partly destroyed by earthquakes and fires. Towers at Topkapu (the Cannon Gate) and at Edirnekapu (Adrianopolis Gate), through which in past centuries the Ottoman janizaries started on their military expeditions into Europe, will be restored.

Construction already has unearthed foundations of the Theodosius Archway and an impressive group of Byzantine mosaics.

Luxembourg Power Project

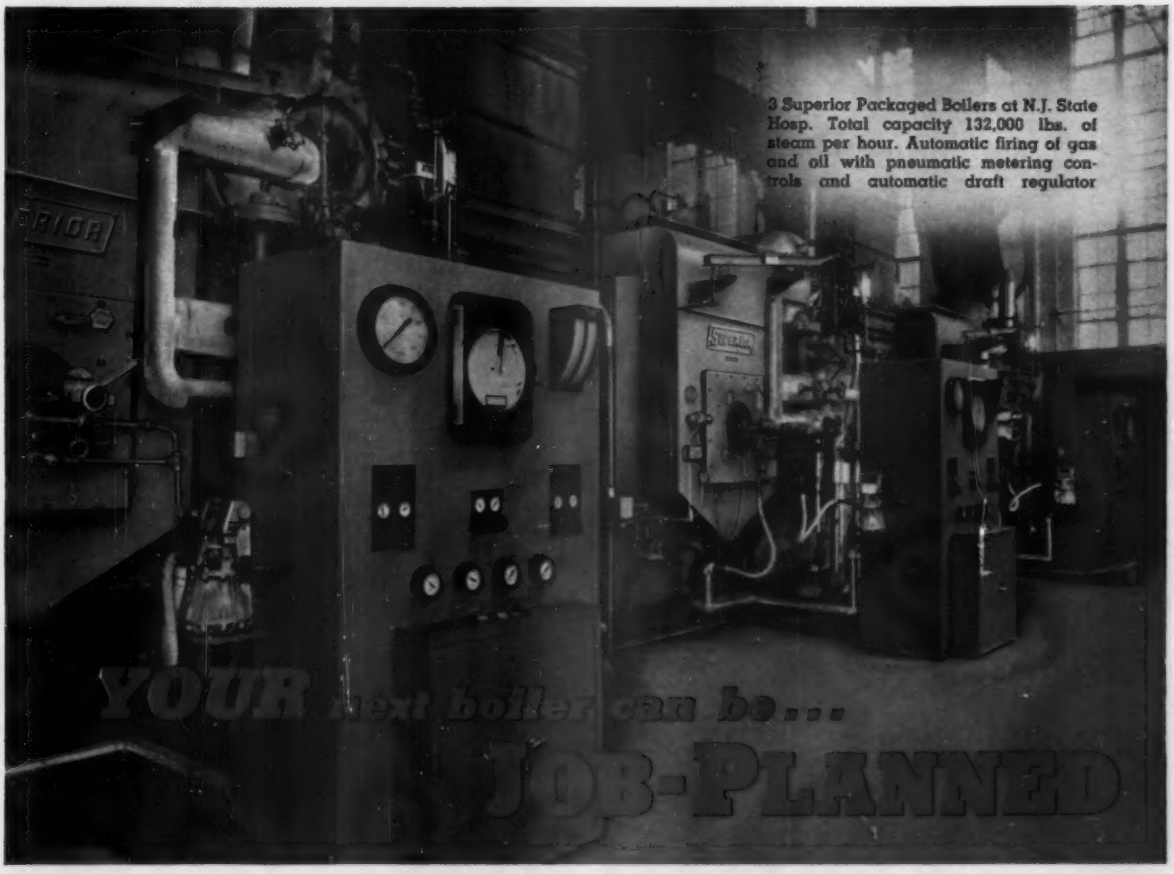
Exploratory drillings have been completed for the largest power plant — 640,000 kw — ever planned in central Europe. It will be near Vianden, Luxembourg in the Our River Valley, the border between Luxembourg and West Germany.

One design feature of the plant is that it will pump water into a storage area at night for supplying peak loads in the daytime. The storage area will consist of upper and lower reservoirs, the upper on a plateau approximately 1000 feet above the lower one. In the first stage of operation, the reservoir will be about 1.5-miles long, will have an average height of 47 feet, and a storage volume of about 80-million cubic feet. The second stage will double the storage volume.

The project, expected to cost $30 million, will be partially financed by the International Bank for Reconstruction and Development.

Interim Solution

Some 80 percent of India's 370 million people live in 550,000 villages. And most of these 300 million huddle in crude mud huts which withstand summer heat but leak and



3 Superior Packaged Boilers at N.J. State Hosp. Total capacity 132,000 lbs. of steam per hour. Automatic firing of gas and oil with pneumatic metering controls and automatic draft regulator

and FACTORY-FIRE-TESTED . . . Too!

Flexibility of choice with a complete "Superior Guaranteed Package"

Capacities to 50,000 lbs. per hour.
Design pressure to 900 p.s.i.g.
Fully or semi-automatic operation.
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Rotary cup burner to 27,000 lbs. per hour.
Single or multiple steam atomizing burners.
Single or twin element feedwater regulator
Steam or air puff soot blowers.
Low and high duty superheaters
Separate packaged economizers.

All this with undivided responsibility, guaranteed performance and efficiency for minimum maintenance.

Why not choose your "guaranteed" packaged boiler to meet the needs of your job, just as you would when specifying a field-erected plant, and still get the advantages of factory assembly, factory-fire-testing, and most important, undivided responsibility?

The Superior Packaged Boilers pictured here are "job-planned" units incorporating burner and control equipment as specified by the purchaser, and tested at actual working conditions before shipment.

Testing involves all functional equipment: forced draft fan, burner, combustion controls, programming equipment, etc., mounted or connected to the boiler, thus providing a guaranteed product with undivided responsibility. Why settle for less? Why purchase half a package? For details write for Catalog 1007-W.

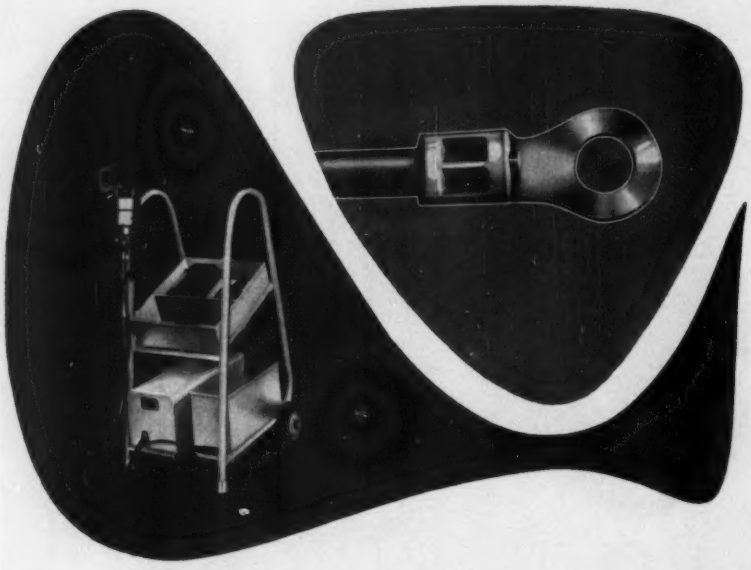
Specialists in PACKAGED BOILERS . . . exclusively

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR
PACKAGED BOILERS

AMP® SOLISTRAND® Terminals

and DYNA-CRIMP® tools—



the right combination . . .

for electrical power generation and distribution

Take any assortment of conductors—solid, stranded or irregularly shaped. Add one A-MP Solistrand terminal. Bring them together in the proper A-MP Dyna-Crimp tool.

The result is always the same—an electrically-perfect, crimp-sure attachment at lower installed cost. Top performance even in adverse conditions.

And Solistrand needs no servicing. This is especially valuable where you have power machinery that must be left unmanned for long periods. Check these important Solistrand features:

- Exclusive double-indented crimp weds Solistrand barrel to conductors in a never-fail attachment.
- Crimping action of Dyna-Crimp tools forces combinations of conductors into one homogeneous mass. It does this at exactly the right pressure—no more, no less—for maximum conductivity and maximum strength with no weakening of conductors.
- Solistrand terminals are scientifically engineered in sizes to fit wires from No. 22 to 600 mcm.

And to serve you better, AMP maintains an international staff of field engineers capable of solving all your terminal problems.

Write for our Solistrand terminal and connector catalog.

AMP INCORPORATED

General Offices: Harrisburg, Pennsylvania

A-MP products and engineering assistance are available through wholly-owned subsidiaries in: Canada • England • France • Holland • Japan

wash away during rainy spells. The government planning commission reports a large proportion of the 56 million huts will have to be rebuilt. Until new ones are finished, it is necessary to reinforce the old ones.

Three methods have been evolved by the Central Building Research Institute, Roorkee, for waterproofing the huts. One is to apply bitumen diluted with kerosene oil and paraffin wax. A second is painting a slurry of cement, hydrated lime, and fine sand in a soap solution. The third solution is silicone in water.

Pipeline Possibility

Plans are under way for a pipeline from Edmonton, Canada to a point on the international boundary near North Gate, Saskatchewan. The proposed 1500-mile pipeline, to be built by Mid-Continental Pipelines, Ltd., will be 30 inches in diameter and have an initial capacity of 150,000 barrels daily.

International Oil Pipeline Corporation, a subsidiary of Mid-Continental, will operate a 900-mile section of the pipeline from the border to Chicago.

Nuclear Power in USSR

Development of nuclear power installations in Soviet Russia, according to Soviet academician I. Kourtchatov, is being pushed along various lines in an attempt to discover the most efficient and economic means of making such power stations available for general use.

Russia is building atomic power stations with generating capacity of 400,000 to 600,000 kw. Of various types, these stations will be used to determine which are economically feasible for general use. Between 1959 and 1960 Russia plans to build several experimental breeders of 50,000 to 70,000 kw.

Russian research, as that of the U.S. and Britain, is looking more toward fusion than fission, making use of lighter isotopes such as deuterium and tritium. Processes similar to those developed by the British

Automotive parts company in Branford, Conn.

A large metal fabricating plant in Toronto, Canada

A shoe factory in Pittsfield, N. H.

INDIVIDUALLY ENGINEERED . . . *yet each was created with pre-engineered Butler components!*

The metal fabricating plant, the shoe factory, and the automotive parts manufacturing plant pictured above, clearly demonstrate the design latitude Butler building components offer.

Each of these facilities presented engineers with vastly different space and load problems. Yet, in each case, Butler pre-engineered components were chosen for the basic structures.

Why? Because the wide variety of Butler components—available from stock—enabled each engineer to design a facility that fitted his exact needs. Equally important, Butler pre-engineered components eliminated much routine engineering—helped create a superior quality facility—quickly and economically.

Butler's clear-span, truss-free design provided spacious, column-free floor space, plenty of unobstructed overhead space for the installation of utilities, conveyors and other equipment. The buildings are easy to ventilate, illuminate, and are economical to cool or heat.

Pre-engineered, precision-made Butler components permit fast assembly, save weeks—even months—of planning and construction time.

For further information on how to build quickly, efficiently, and economically with Butler components, contact your Butler Builder. He's listed in the Yellow Pages of your phone book under "Buildings" or "Steel Buildings." Or write to us direct.

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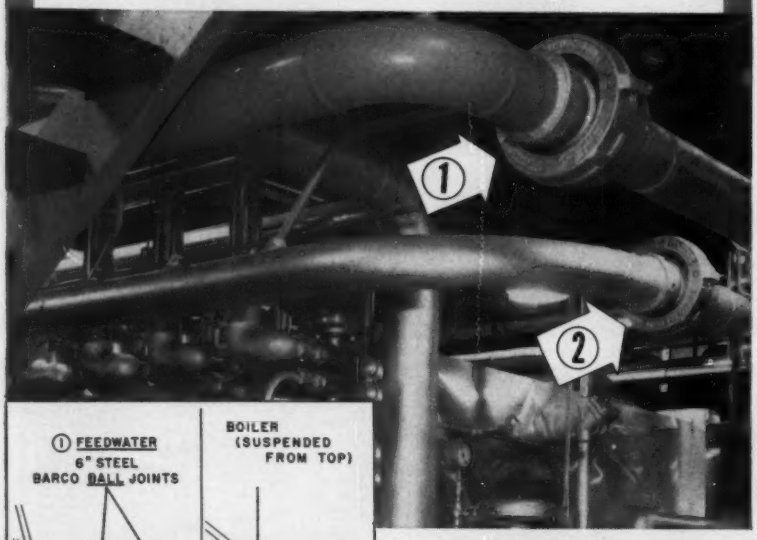
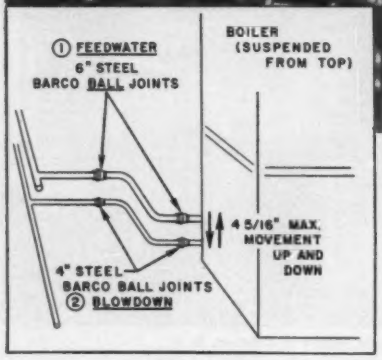
. . . where BOILERS move UP and DOWN





BARCO Ball Joints

The schematic diagram at left shows how Barco Flexible Ball Joints of steel construction are used in a new Florida utility plant—design pressure 600 psi, 500°F. The above photo shows a close-up view of two of the joints (see arrows). Two more matching joints, 4" and 6", are located out of the picture to the left. The 4" joints have metal gaskets. The same utility also uses 10" Barco joints on gas fuel lines. Other uses in power plants are for flexible connecting lines to oil burners, soot blowers, and other auxiliary equipment.

Flexible Pipe Connections!

The rapidly increasing use of Barco Flexible Ball Joints for solving piping problems in POWER PLANTS is significant for several key reasons:

1. Substantial *space saving* as compared to other methods in crowded piping areas.
2. Unlimited flexibility and movement. Utmost simplicity.
3. No heavy pipe anchoring required. No "end thrust" developed under pressure.
4. Ability to handle compound movement (where twisting is combined with thermal expansion and contraction).
5. Easy to engineer joints into piping to provide for any degree of flexibility, expansion, or movement required.
6. Maximum safety for high temperature applications. All-metal construction available. Special alloys can be specified.
7. Basic design is pressure sealing against leakage and self-adjusting for wear.
8. Virtually no deterioration. Able to stay in service for years without repairs or maintenance. No lubrication.

New Bulletin No. 31 contains interesting diagrams showing how to solve many common pipe expansion problems EASILY, ECONOMICALLY. *Ask for a copy;* see your nearest Barco representative or write:

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ANNIVERSARY
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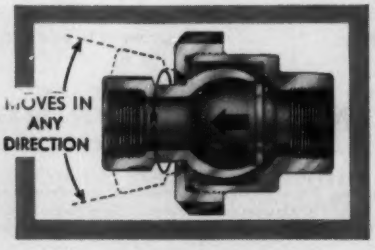
BARCO MANUFACTURING CO.
5721 Hough Street, Barrington, Illinois
The Only Truly Complete Line of Flexible Ball, Swivel, Swing and Rotary Joints
In Canada: The Holden Co., Ltd., Montreal



scientists have been investigated but control of any energy liberated thus far has been limited to small experimental activities.

Magnetic currents, as discovered by Britain's scientists at Harwell, have been used by the Russians to create thermic isolation within containers where high temperatures of deuterium plasma are developed.

New Amsterdam Harbor Facilities

The Netherlands government and the city of Amsterdam are considering a $79-million project to expand the city's outlet to the North Sea at Ijmuiden and Amsterdam port.

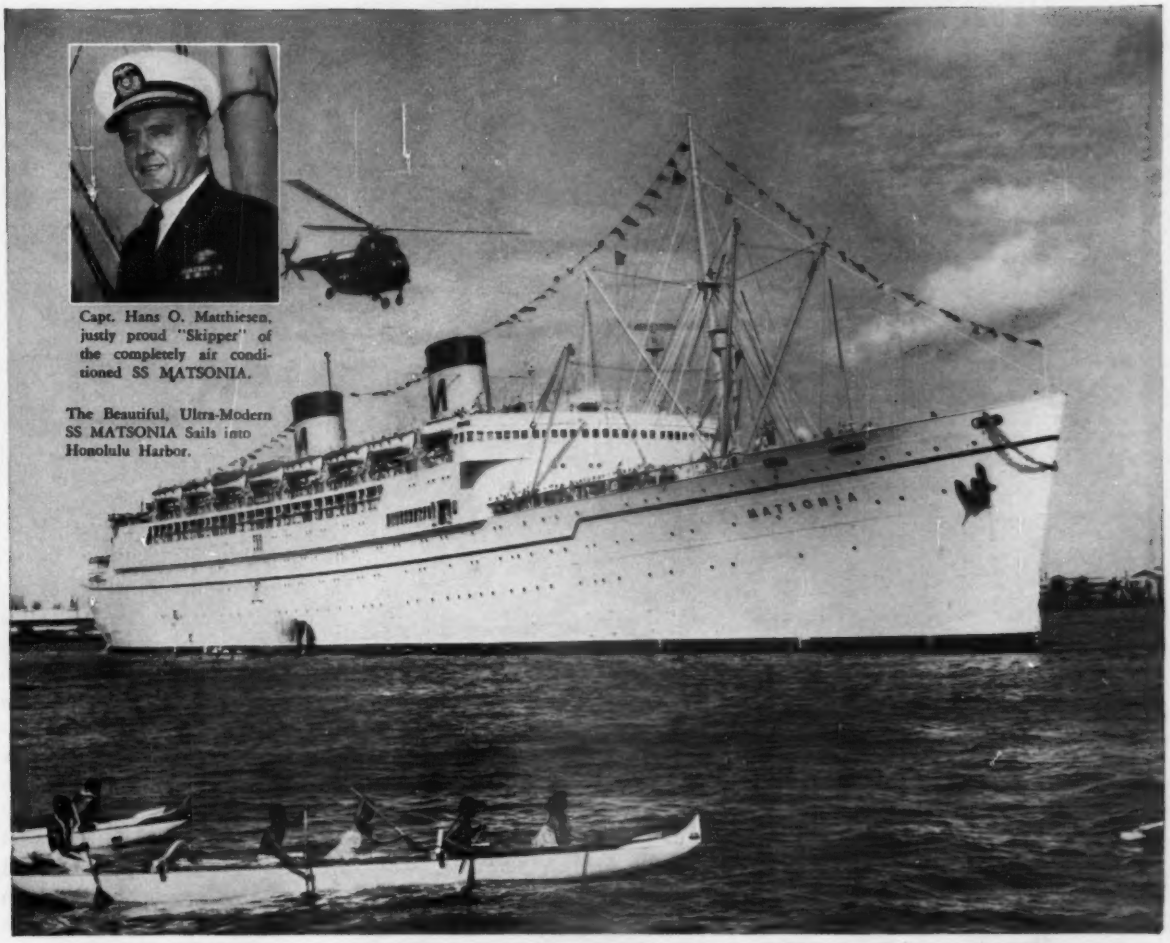
Principal features of the project are expansion of the locks system and breakwaters at Ijmuiden, widening and deepening the North Sea Canal, and doubling the Amsterdam harbor area. Expansion of the locks and piers forming the breakwater will permit vessels of over 60,000 tons to dock.

The large breakwaters at Ijmuiden, constructed in 1876, will be replaced by new breakwaters extending 1.2 miles into the open sea instead of the present 0.9 mile, and the entrance between the piers, now 800 feet, will be widened to 1300 feet. A second large lock of about the same dimensions as the present lock, largest in the world, will be built at Ijmuiden. The new lock will be 1300-ft long and 130-ft wide with a 50-ft sill depth.

Sun Furnace

A special solar furnace constructed by Australian scientists at Sydney University will test resistance of metals to temperatures ranging from 5500 to 7000 degrees Fahrenheit. Such tests are important for metals used in rockets, jet engines, and atomic power plants.

Main feature of this solar furnace will be a 65-ft four-leg tower supporting a 12-ft diameter concave paraboloidal mirror. This mirror will collect sunlight reflected onto it by another mirror – a heliostat – on the ground. From a small laboratory in the tower, test material



Capt. Hans O. Matthiesen, justly proud "Skipper" of the completely air conditioned SS MATSONIA.

The Beautiful, Ultra-Modern SS MATSONIA Sails into Honolulu Harbor.

MATSON LINES DEPEND ON "BUFFALO" FANS FOR RELIABILITY AT SEA

When a major steamship line spends 20 million dollars to modernize a passenger ship, you can be sure that the results achieved far out-weigh the costs.

This is certainly true of the all-new MATSONIA. Unrivalled safety, luxury, convenience and comfort welcome the fortunate passengers who sail on this pride of the Matson Lines. For example, passengers and crew can "tune-in" just the climate they desire in each room by simply turning a dial.

Vital to the MATSONIA's unique, new selective air conditioning and ventilation system is a huge battery of "Buffalo" Fans. It is logical that "Buffalo" Fans were selected for the important air moving job on this super-liner. During the past 81 years, "Buffalo" Fans have earned a world-wide reputation for highest efficiency, extremely quiet operation and long-lasting dependability.

Just as Matson Lines depend on "Buffalo" Fans for *reliability at sea*, so *you* can depend on "Buffalo" Fans for your own air jobs... ashore or afloat. Insist on "Buffalo" Fans for *your* next air moving project... expert engineering service is as close as your nearby "Buffalo" representative.

The MATSONIA's Chief Engineer, Helge Lundby, is pleased with the fine performance of this and the many other "Buffalo" Fans aboard his ship.

BUFFALO FORGE COMPANY

Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

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EXHAUSTING • FORCED DRAFT • COOLING • HEATING • PRESSURE BLOWING

Consultants Data File . . . one of an interminable series

PERMANENT HOME FOR FLOATING DICE GAME

novel lighting system developed by ingenious engineer

When the Charity Street Cultural and Educational Council decided to build the soaring structure shown above, they called in James Mafia to design an efficient lighting system well adapted to the special needs of the organization.

Throughout the building Mafia used low-hanging lamps suspended from tracks to provide mobile, glare-free light for the Council's evening functions. Because activity is heaviest on weekend evenings, Engineer Mafia wisely chose Heinemann Hydraulic-Magnetic Circuit Breakers for the building's branch circuits. Says Mafia, "Only with Heinemann could I be assured of full current-carrying capacity protection regardless of temperature conditions. Since the Council's game-room discussions often grow quite heated, the use of thermally-actuated circuit protection devices was precluded. I specified Heinemann because only Heinemann Circuit Breakers will hold full, rated current capacity through any ambient temperature range."

Just off the press . . . a new and unexpurgated edition of our famous treatise on foolproof branch circuit protection. If you'll just write for Bulletin 3103, we'll send you a copy as soon as the ink's dry.

S. A. 1429

HEINEMANN

HEINEMANN ELECTRIC COMPANY
127 Plum Street, Trenton 2, N. J.

Circuit breakers

will be lowered to where solar heat gathered by the concave mirror can be concentrated.

Scientists hope the furnace will solve present difficulties in testing metals for heat resistance. Conventional test furnaces are "dirty," since the test material contacts other materials and becomes contaminated, especially if melting occurs. Chemical action helps to cause dissolution. Metals can be tested under "clean" conditions in high-vacuum heating, but this is expensive and involves problems like gases escaping from the test materials, preventing maintenance of a high vacuum.

Argentine Oil Line

Yacimientos Petroliferos Fiscales (YPF), the Argentina state petroleum entity, plans construction of a 660-mile oil pipeline from Lujan de Cuyo (Mendoza) to Buenos Aires (La Plata).

Included in the project are pumping stations, storage and distribution plants, and a communications system. The 10¾-in. diameter pipeline will carry both refined products and crude from which wax will be removed in operations in the expanded Lujan refinery.

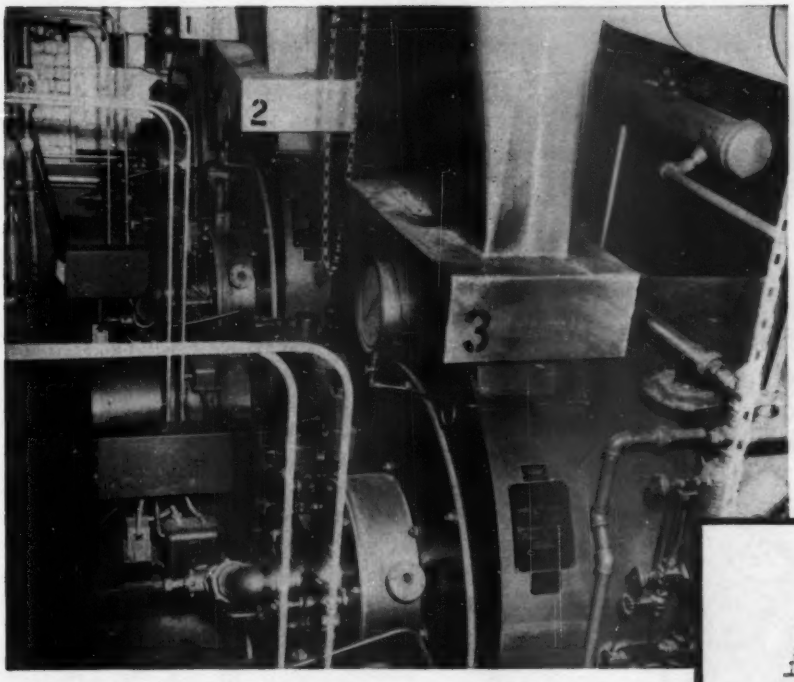
Super Tunnels

Four new supersonic wind tunnels, only ones of their kind in Europe, will provide experimental facilities for speeds up to several times that of sound. Construction crews are working day and night to complete these tunnels, the largest of which, "S2," will be 318 by 84 feet.

To be finished by 1960, the tunnels are located in eastern France close by a 110,000-hp transonic wind tunnel which went into use at Modane several years ago and is the most powerful in the world.

Portuguese Railway Program

Portugal's rail transport program, part of the proposed second 6-year development plan beginning in 1959, provides for continued electrification and dieselization of the

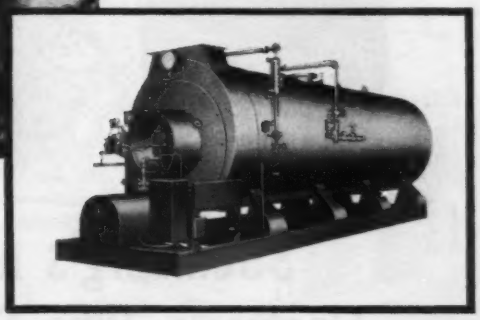


HERCULES-GALION PRODUCTS, Inc., Saves $15,000 Per Year!

Hercules-Galion Products, Inc., of Galion, Ohio, makers of dump truck bodies, ready-mix concrete truck equipment, and steel burial vaults, retired two old style boilers.

To improve heating efficiency, they installed three Cyclotherm 125 h.p. combination light oil/gas package steam generators. The total savings per year comes to $15,000.

As growing production or expanding plant facilities require more steam, Cyclotherms can be added when needed.



CYCLOTHERM

Steam capacity that grows with the plant!

When you recommend Cyclotherm Steam Generators you recommend a steam source that can be quickly and economically expanded to meet plant expansion. For Cyclotherm's wide range of capacities permits the addition of exactly as much new capacity as may be needed at any time. Will 518 lbs. of steam per hr. suit the requirements? That's what a 15 HP Cyclotherm produces. Or are 25,875 more steam lbs. per hour wanted? In that case, a 750 HP Cyclotherm fills the bill. And between these extremes there are sixteen intermediate sizes to choose from.

Compact Cyclotherms are also kind to boiler room space – the Cyclotherm is up to ⅓ smaller than the ordinary package boiler. Installation is easy—no costly stack, no excavation, no foundation. The Cyclotherm is shipped complete – ready to operate. Burner and boiler are built together to work together with *one* manufacturing responsibility back of the entire unit.

Cyclotherm's Cyclonic Combustion guarantees a minimum of 80% efficiency. Larger units operate at from 30% to 100% of rated capacity with no loss of efficiency. Smaller units operate on and off automatically according to load requirements. With simpler design and fewer parts, Cyclotherm reduces maintenance costs by from 30% to 50%. Cyclotherm's world-wide service organization gives prompt service on every call. For full information, write us today.

There are 18 Cyclotherm models, ranging from 15 HP to 750 HP. Burns oil and/or gas. The Cyclotherm meets all state requirements and is built in accordance with A.S.M.E. and National Board Standards and bears the label of Underwriters' Laboratories, Inc. Guaranteed against any defect in materials or workmanship. Cyclotherm also manufactures a complete line of Hot Water Generators in 10 capacities, from 670,000 BTU per hr. to 6,700,000 BTU per hr.

YEARS AHEAD IN STEAM & HOT WATER GENERATION

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A Division of National-U.S. Radiator Corp., Oswego, N.Y.

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National-U.S. Radiator Corp.
57 E. First St., Oswego, N. Y.

Please send me your booklet *Cyclotherm Cyclonic Combustion*, also rotogravure copy of *Cyclotherm Sales Steam* with illustrations and descriptions of Cyclotherm installations.

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Here are some (just a few) of the many PLUS features not offered by others

- Jewelled Master Clock movement with automatically wound 72-hour spring power reserve.
- Secondary Clocks standard with hourly and 12-hour supervision — correction cycles completed in *only 60 seconds.*
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- Manual signals sound instantly on depressing program key.
- Seven-channel transmitter — one for clock supervision, six for program signals.
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A product of the laboratories of one of the largest clock manufacturers in the world—*YOUR GUARANTEE of performance, quality and dependability.*

For complete details, write:

Stromberg TIME CORPORATION
Thomaston, Connecticut

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system. Essentially, it is an extension of work begun in the first plan.

The program calls for $28 million to be spent on electrification of the Lisbon-Oporto line. By mid-1958 the line from Lisbon to Entroncamento will be completed. The new plan calls for continuing electrification from Entroncamento north to Oporto.

Dieselization will proceed with the purchase of wide-gage diesel locomotives ranging from 800 to 1600 hp and narrow-gage diesel locomotives from 800 to 1000 hp. The diesels will cost $5 million.

The plan includes workshops, signaling devices, telecommunications equipment, and locally produced rolling stock.

According to the plan, a total of $45.5 million will be invested by the concessionaire, Companhia dos Caminhos de Ferro Portugueses.

Rotterdam-Rhine Pipeline

A 200-mile pipeline from Rotterdam to Wesseling on the Rhine will be installed by the newly formed Rotterdam-Rhine Pipeline Co., Ltd.

The pipeline will pass through Godorf, where Shell is planning a major refinery installation. Planned throughput is estimated at 8-million to 20 million tons.

The pipeline should be completed in 1960 at a cost of 35 million. Bechtel Corporation, prime contractor, will do engineering.

Prestwick to Expand

Scotland's Prestwick International Airport will extend its facilities to handle modern jet aircraft and to meet an expected 25 percent increase in eastbound passengers from the U.S. and Canada. Extension of the main runway will be completed by mid-summer. Other plans include a new terminal building, scheduled for completion by 1960. Prestwick handled 260,000 passengers last year. It is estimated that 175,000 terminal passengers and 150,000 to 200,000 transit passengers on the Atlantic routes will pass through in 1960. ▲▲

Here's Why . . .

You Save With Silicone Insulated Outdoor Motors for Power Stations

Silicone insulation is establishing a trend toward less costly enclosures for auxiliary drive motors in power stations. By readily withstanding moisture and contaminants circulated in ambient air, Dow Corning silicone insulation makes possible more open enclosures and lower cost per horsepower.

Leading electrical equipment manufacturers already offer complete lines of silicone insulated "all-weather" motors in ratings from 100 to 5000 horsepower.

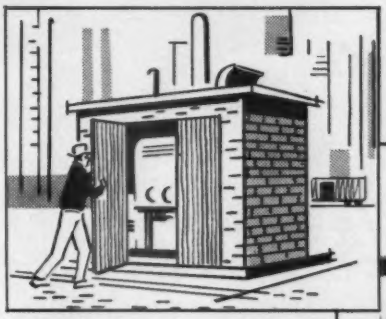
Safe, reliable operation outdoors the year 'round is assured by Dow Corning silicone insulation. Experience has shown silicone insulated motors readily withstand torrential rains, hurricane winds, corrosive fumes, fly ash, dust, salt air, snow, sleet, cold, heat — even flooding.

Extra overload capacity is provided by the silicone insulated windings. As a general rule, silicone insulation offers a 50% greater service factor and lasts at least 10 times longer than Class B insulation under similar operating conditions. That's why for the most dependable auxiliary drive motors, it's wise to

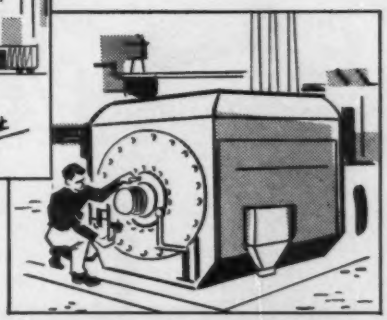
Specify DOW CORNING SILICONES *and Save*

JUST PUBLISHED!

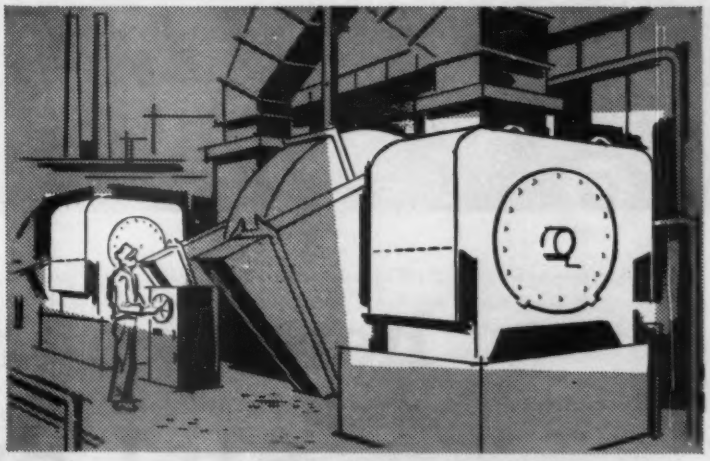
Send for your copy of new 8-page brochure detailing how silicone insulation cuts motor enclosure costs while adding to the reliability of electrical equipment.



Initially, motors were sheltered in buildings . . .



Later, motor enclosures themselves sealed out surrounding atmosphere



Now, silicones protect motor parts permitting the circulation of ambient air . . . lower-cost enclosures.

first in silicones

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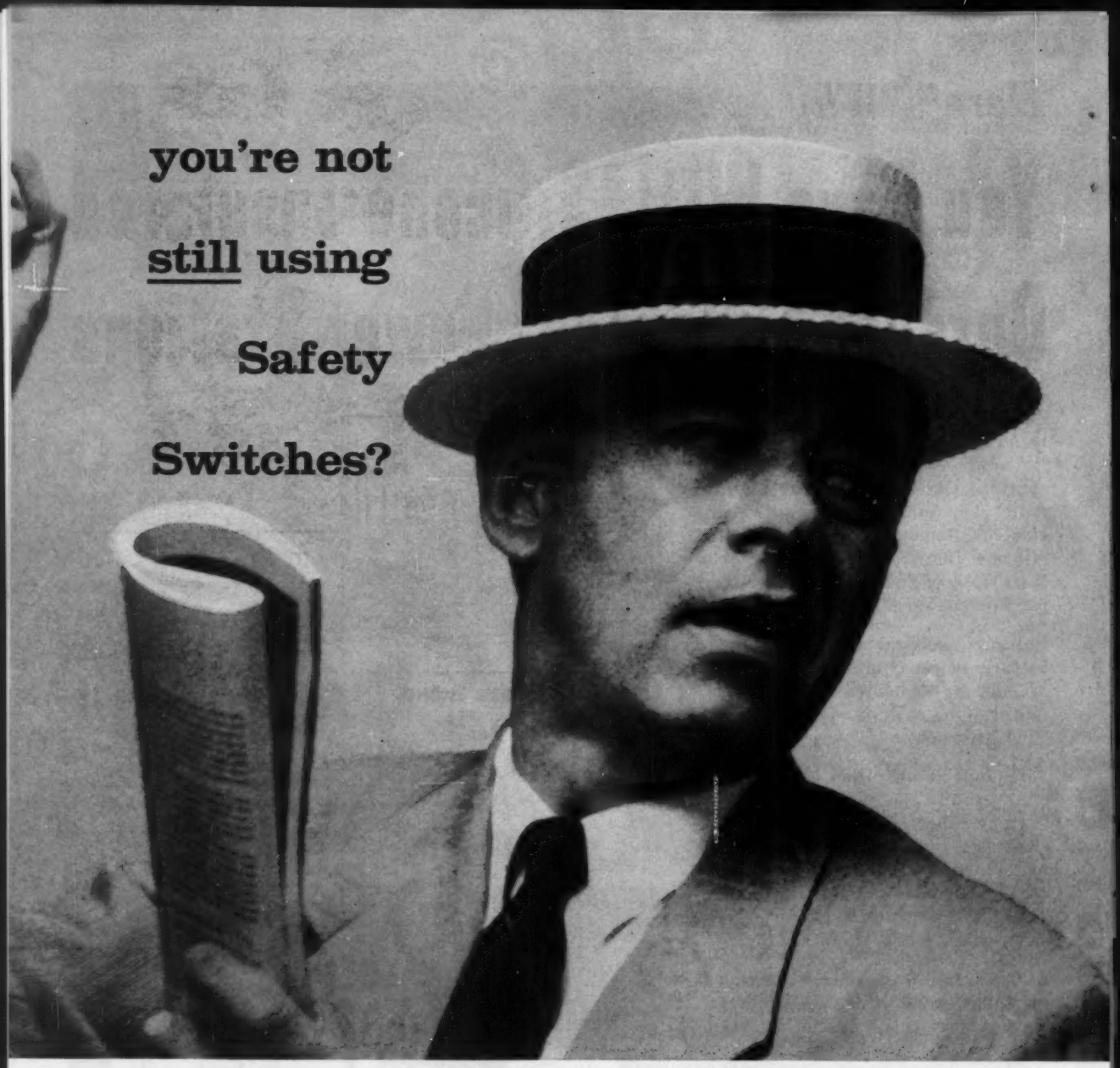
MIDLAND, MICHIGAN



here are the facts on AB-I Breakers vs Safety Switches

Safety switches versus AB-I breakers is an old, old controversy. Westinghouse manufactures both at their Beaver, Pennsylvania plant.

Here's their authoritative, unbiased report in the interest of better circuit protection:

Fact: AB-I's cost less. In most all motor applications, AB-I's are lower priced than an equivalent safety switch equipped with fuse. (For a rating-by-rating cost comparison, write to the Westinghouse address shown below.)

Fact: AB-I's require less mounting space. To protect a given motor size, the AB-I breaker will nearly always be smaller (up to 40% smaller, never larger) than an equivalent safety switch.

Fact: AB-I's require no maintenance. No costly fuses to replace; no production time-loss due to fuse replacements; no maintenance of any kind!

Fact: AB-I's are safer. With breaker protection, motors can't single-phase. There are no exposed live parts on an AB-I breaker to endanger workmen; no need to open the cover to reset the handle; no dangerous fuse replacements.

It's a fact. AB-I breakers are the safest, surest, least costly means of circuit protection. On your next order, order the best in AB-I breakers—by Westinghouse.

J-30300

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Westinghouse

Westinghouse Electric Corporation
STANDARD CONTROL DIVISION
Beaver, Pennsylvania

THEY'RE HERE NOW . . . AND ONLY WESTINGHOUSE HAS GOT THEM

Complete Line of Quicklag Circuit Breakers

There's only one circuit breaker design best suited for lighting and power circuits—Quicklag®! And there's only one man who can offer you a full range of these small-size, high-interrupting capacity breakers—your Westinghouse Sales Representative!

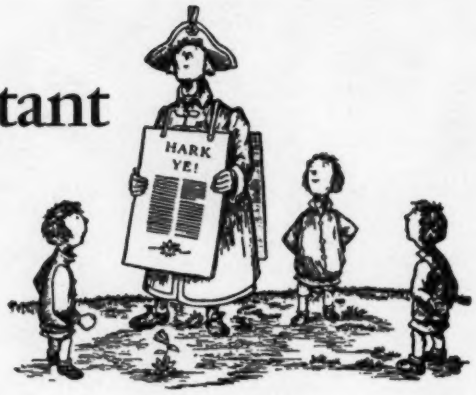
These Westinghouse Quicklag circuit breakers are available *now* in two models—fast-mounting plug-in Quicklag P; and versatile front-connected Quicklag C. Both are available in 1-, 2- and 3-pole construction. Both incorporate all of the design features that have made Westinghouse breakers the standard for industry. For example: De-ion® arc quenchers for fast, safe arc extinguishing; quick-make, quick-break trip-free mechanism that prevents contact "teasing"; silver-alloy contacts; insulated common-trip bar; cooperative thermal-magnetic trip; all this plus accessories and modifications for additional versatility.

A call to your local Westinghouse Sales Representative will give you the full story on the Westinghouse Quicklag line. Or you may write to: Westinghouse Electric Corporation, Standard Control Division, Beaver, Pennsylvania. J-30299

YOU CAN BE SURE...IF IT'S
Westinghouse

Westinghouse Electric Corporation
STANDARD CONTROL DIVISION
Beaver, Pennsylvania

News for the Consultant



Fort Pitt Bridge

The new Fort Pitt Bridge, crossing the Monongahela River at Pittsburgh, is the world's first double-deck tied arch bridge using box sections as arch ribs, and with the tied arch using trusses instead of girders as ties. The 750-ft span will carry four lanes of one-way automobile traffic on each level, and will link east and west sections of the Penn-Lincoln Parkway.

Designer is George S. Richardson, consulting engineer for the Pennsylvania Dept. of Highways.

The Fort Duquesne Bridge of similar design, to be built across the Allegheny River, will serve areas northwest of Pittsburgh and will be connected to the Pennsylvania Turnpike.

Atoms in Alaska

The first nuclear power plant to be built in Alaska will be erected for the U.S. Army Corps of Engineers at Fort Greely, near Fairbanks, by Alco Products, Incorporated.

The reactor will be a 1700-kw pressurized water plant. This new reactor is based on the APPR-1 system, but will operate at twice the output of the original design from the same size core. Approximately one-half of the reactor's thermal output will

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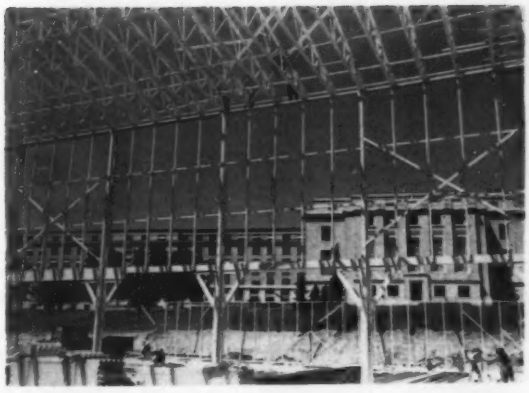
be used to generate electricity; the remainder will be used for space heating.

The Fort Greely plant will furnish all the electrical power normally consumed by the Army post, and the existing conventional generating station will be maintained on a standby basis after new construction is completed. Initial work is under way, and the plant is expected to be in operation sometime in 1960.

Geneva Nuclear Exhibitions

The second United Nations International Atoms for Peace Conference, being held this month in Geneva, Switzerland, includes separate governmental and commercial exhibitions for atomic products and services from all over the world.

Twenty-one nations—United States, Russia, United Kingdom, France, Canada, Argentina, Australia, Belgium, Czechoslovakia, Denmark, German Federal Republic, Hungary, India, Italy, Japan, Norway, Spain, Sweden, Switzerland, Union of South Africa, and Venezuela – are participating in the governmental exhibit in a new 90,000-sq ft temporary structure erected near the Palais des Nations, site of the Conference. The U.S. displays include two operating research reactors and a number of working devices illustrating experimental approaches to the harnessing of fusion power. A 38-ft high full-scale model of the pressure vessel and core of the Shippingport power reactor also is displayed.



Wooden framework of 90,000-sq ft Geneva exhibit building with Palais des Nations in background.

In addition, there will be a commercial exhibit in the Palais des Expositions in downtown Geneva – the largest commercial display of atomic products and services yet held. Highlight of the U.S. section, represented by 49 industrial firms and the Atomic Energy Commission, is a full-scale model of the core of a 150-Mw reactor. Two more re-

Your ideas work better when you work with HONEYWELL

The following pages bring you the latest developments in automatic controls from Honeywell. They widen your choice of products, give you more to work with.

For complete information on these new control products and systems, call your nearest Honeywell sales office. Honeywell provides 112 offices throughout the country; each is staffed with capable control specialists to assist you in preparing proposals and writing specifications.

Look over these new products and systems. And, remember, they are backed by the kind of support only Honeywell can offer you.

FOR MORE TO WORK WITH ... WORK WITH HONEYWELL

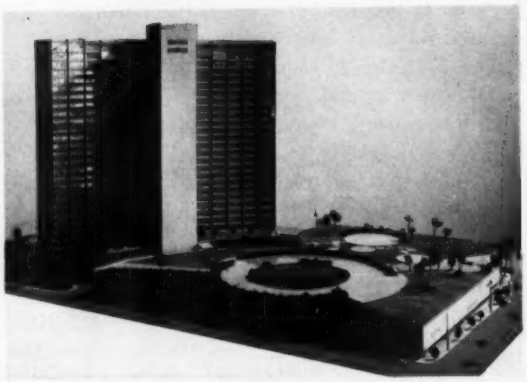
search nuclear reactors, provided by the Atomics International Div. of the North American Aviation Co. and Aerojet-General Nucleonics, also will be in operation. The AEC exhibit has as its theme the partnership between U.S. private enterprise and the government.

United Nations officials believe this year's U.N.-sponsored Conference is the largest formal international meeting ever held. The first Geneva Conference on Peaceful Uses of Atomic Energy was held three years ago.

Kaiser Center

The $45-million Kaiser Center to be constructed on a seven-acre site in downtown Oakland, California will include a 976,000-sq ft, 28-story office building to house world headquarters for the Kaiser industrial organization and a 674,000-sq ft structure devoted to shops and a parking garage. Welton Becket and Associates, San Francisco, architects and engineers, designed the Center.

The walls of the glass, aluminum, and steel office structure will be curved following the shore line of Lake Merritt, and will be supported on a 5-ft thick concrete slab foundation, 62-ft wide and 420-ft long. A ceiling type radiant panel heating and cooling system, designed by Dudley Deane and Associates, San Francisco consulting engineers, will

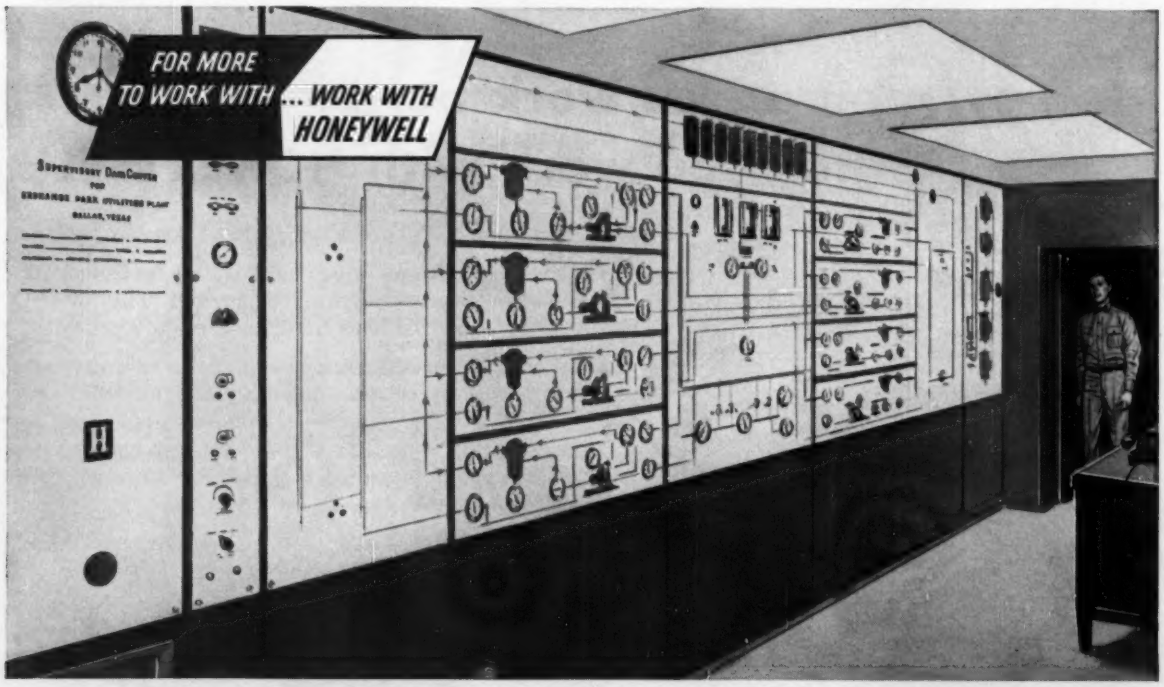


Model of 28-story Kaiser Center to be erected in Oakland, California on Lake Merritt shore line.

be used. This is believed to be the largest single installation of its kind in the world.

The ceiling will be constructed with perforated acoustical tiles of aluminum. A sound-absorbing blanket and the pipes carrying hot and chilled water will be concealed behind the tiles.

Comfort cooling will require a 2500-ton refrigeration system with provisions for circulating 5000 gpm of 45 F water throughout the building. Condenser



The Supervisory DataCenter for the Exchange Park Center in Dallas, Texas, provides an operational check on compressor and boiler pressures for the entire center which will eventually include 4 major office buildings, a department store, 150 retail stores, a thousand-room hotel, an auditorium and a medical center. Each component of the system is represented in miniature on the 30 foot panel. Owner: Wm. A. Blakely; Engineer: Blum & Guerrero; Architect: Lane, Gamble & Associates; General Contractor: J. E. Morgan & Sons; Mechanical Contractor: Kieffer Plumbing & Heating; Electrical Contractor: Fischbach & Moore.

water at the rate of 7500 gpm will be circulated through a two-cell induced draft cooling tower.

Three boilers will produce 12,500 lbs of steam per hour each. Steam-to-water heat exchangers will be installed on every fourth floor to provide 110 F water for use in the radiant ceiling panel grids.

A modular underfloor duct system will be used to carry electrical and telephone lines. Continuous-strip recessed fluorescent lighting will be used throughout the building.

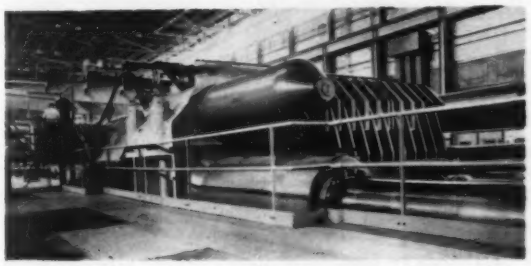
Indiana, Illinois Toll Roads to be Connected

Indiana and Illinois have agreed to a joint $25-million improvement program for U.S. Highway 41 to connect the east-west Indiana Toll Road and the Illinois Tri-State toll road system. The present two-lane highway will be made into a modern four- or six-lane expressway for its entire 4⅛-mile length. Financing will be on the basis of a 50-50 split with the Federal government.

8000-Ton Plate Stretcher

The world's widest aluminum plate stretcher, capable of handling rolled aluminum plate up to 152 inches wide and 6 inches thick, is in operation at Alcoa's Davenport, Iowa plant. The new machine can exert a force of 8000 tons.

Stretch-straightening is achieved with the machine by either setting the pressure to a predetermined stress in the plate or by stretching the plate to a predetermined length. The plate can be expanded beyond its elastic limit, redistributing stresses over the plate's cross-sections, increasing its strength, and eliminating distortion.



Mammoth new plate stretcher is called "Capital."

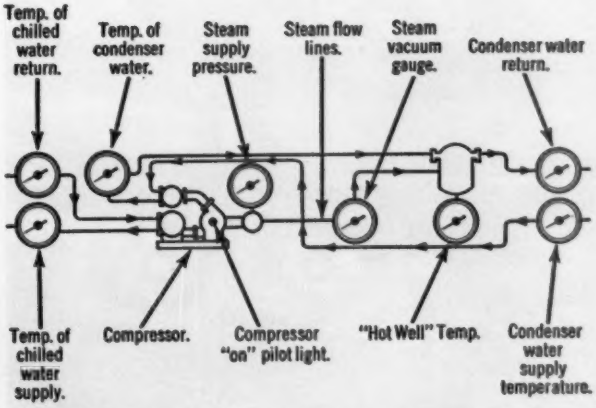
Loewy-Hydropress Division, Baldwin-Lima-Hamilton Corp., designed and built the unit.

First Water-Cooled Generators

The nation's first two steam turbine-driven generators with water-cooled stator windings are being built by General Electric Company. The new design

*Honeywell Supervisory DataCenter**

Central supervision of air conditioning for a 120 acre park



One of eight steam-driven refrigeration compressor systems depicted in miniature on the DataCenter panel. Other modules on panel provide data on performance and operation of 9 cooling towers and 5 boilers, start-stop buttons and pilot lights for water pumps, temperature selector knob for the heat exchanger, pH meter for condenser water and several alarms, audible and visual.

*Trademark

The 30-foot Supervisory DataCenter panel for Exchange Park is installed in the Utilities Building. It enables the operating engineers to check on the operation of the steam turbine driven refrigeration compressors and boiler plant steam pressures that serve this entire project with steam and chilled water for their respective air conditioning systems. Pilot lights show which equipment is operating. Fluid pressures and temperatures are indicated continuously.

The added efficiency and savings which centralized control such as this offers building owners can be custom designed for your clients. Only Honeywell has the equipment, facilities and experience to develop special panels to suit all buildings. Honeywell Industrial instruments are precise and dependable. Honeywell panel manufacturing facilities are the largest in the control industry. And Honeywell has over 400 centralized control panels, of great variety in operation.

Honeywell

First in Control

affords the possibility of generator ratings as high as 1-million kva.

Water cooling is being incorporated in the two 265,000-kva generators of the 450,000-kw cross-compound steam turbine-generator unit for the Philip Sporn Plant of the American Electric Power System at Graham Station, West Virginia.

It is felt that water cooling will not only double present conventional oil-cooled generator ratings, but will result in significant savings in power plant construction costs. In addition, much higher rated generators can be built and installed within the limitations on size and weight presently imposed by shipping restrictions.

Laboratory tests have indicated no adverse electrolytic or chemical action result with water being circulated as the coolant in stator windings.

New Florida Key Routes Studied

Dade County highway commissioners have approved plans for a new $35-million overwater automobile crossing from Miami Beach to Key Largo, with a connection to the South Dade mainland. A financial feasibility report is being prepared by Wainwright and Ramsey, financial consultants of New York, who are studying the proposed project to determine if tolls alone will pay for the additional causeways.

Central Illinois Ups Capacity 50,000 kw

Stone & Webster Engineering Corporation will design and construct an $11-million extension to Central Illinois Electric and Gas Company's Sabrooke Station, in Rockford, Ill. The 50,000-kw addition, Unit No. 4, is scheduled for completion in 1961. Steam generation will be at 1450 psi and 1000 F, with 1000 F reheat. The boiler will be arranged for pulverized coal firing.

Stone & Webster designed and built the original three Sabrooke Station units, with a total net capacity of 88,000 kw.

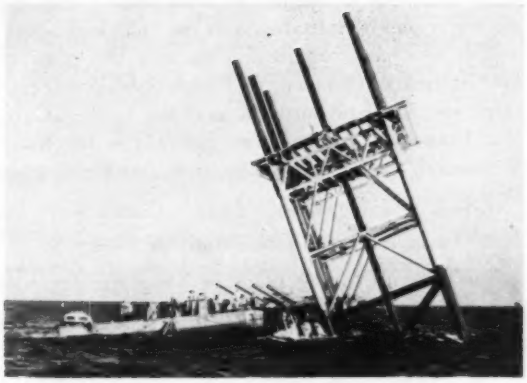
Controlled Platform Launching Barge

A new submersible barge — the controlled platform launching barge — sharply reduces costs involved in the installation and recovery of offshore oil well drilling platforms. Present installation methods require the use of a derrick barge and four auxiliary craft. The operation normally takes a week and a half and costs about $100,000. Installation time is halved and costs reduced by one-third by use of the new controlled platform launching barge.

The unit consists of two barges hinged together. The platform rests on its side on both barges during transportation to the drilling site. During installation, it is fastened only to the submersible

Hewlett-Packard Plant, Palo Alto, California uses Light Saver installations to save on lighting costs. Architect: Clark, Stromquist, Potter and Ehrlach, Palo Alto; General Contractor: Wells P. Goodenough; Electrical Contractor: Progress Electric Company; Mechanical Contractor: Allsberry Plbg., Htg. & Sheet Metal Co.; Structural Engineer: Hall, Pregnoff & Matheu.

Offshore oil drilling platform is transported to site in horizontal position on launching barge.



Platform is then swung into vertical position and lowered to ocean floor by submersible barge.

barge, the smaller of the two. The combined action of water ballasting, accurately controlled by two 1000-gpm centrifugal pumps, and hydraulic ram action slowly swings the barge and platform through a 90-degree arc. Four double-acting hydraulic rams each produce a thrust of 300 tons and a pull of 250 tons.

Once upright and resting on the bottom, the platform is released from the barge, and the platform secured to the ocean floor with its integral steel pilings. Placement takes two hours. The procedure is reversed when recovering a platform and transporting it to another location for installation.

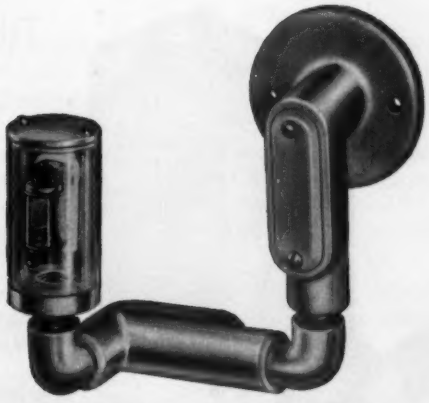
L. B. Christenson Engineers, Inc., of Pasadena, Texas, developed the new unit.

"Golden Gate Authority" Proposed

California's Toll Bridge Authority is restudying all San Francisco Bay area crossing surveys dating back more than 10 years in its approach to the problem of constructing additional bay crossings. It also proposed that a "Golden Gate Authority" be created to operate all toll bridges, commercial airports, and public harbors in a five-county bay

*For your electrical systems . . . the Honeywell Light Saver**

Combined with modern daylighting, it brings light bill savings as high as 80%



A Light Saver phototube accurately measures the amount of daylight entering each lighting zone. A switching motor operates from each phototube's signal, automatically increases or decreases that zone's artificial lighting as needed to maintain optimum lighting.

This new Honeywell Light Saver system using photoelectric principles, automatically measures daylight and supplements it with artificial light to maintain the correct number of foot candles in working areas.

The Light Saver eliminates wasted electricity, brings your clients important savings in lighting bills—as high as 80%. It's especially suited to skylighted buildings like the Hewlett-Packard plant on the facing page.

Industrial plants, schools, hospitals and other institutions are logical users for the Light Saver system. A Honeywell specialist will assist you in applications, provide you with all the information you want for specifying. Call him at your nearest Honeywell office.

*Trademark

Honeywell

First in Control

area. Enabling legislation to form such a regional authority will be introduced in the 1959 legislature.

The new authority would include the ports of San Francisco, Oakland, and Richmond; San Francisco and Oakland airports; and the Golden Gate, San Francisco-Oakland Bay, San Mateo-Hayward, Richmond, San Rafael, Carquinez, and Dumbarton bridges.

New Texas Plant for Johns-Manville

Johns-Manville's new plant in Denison, Texas is the nation's first automatically controlled, continuous process facility for the production of asbestos-cement pipe. Annual production capacity is rated at 48,000 tons.

New facility for production of "Transite" pipe.

A completely automatic system weighs, mixes, and conveys raw materials through chutes and pneumatic conveyors to a newly designed continuous process machine. This machine transfers the wet asbestos-cement mixture to a felt roll which carries it to a steel mandrel. The material then is transferred to the mandrel under pressure and laminated into cylindrical pipe sections. Pipe mandrels are magazine-fed to the laminating section permitting uninterrupted operation.

Following the forming operation, the mandrel is removed, and the pipe section transferred to trays for air and steam curing. Pipe ends then are machined for fittings with an automatic lathe. This completed pipe is tested hydrostatically to 3½ times its maximum working pressure and given a final air cure before shipment.

The main plant building, of structural steel construction, provides more than 186,000 square feet of area. A 9100-sq ft office building, a silica grinding building, a sales demonstration and shipping building, and a boiler house for process steam complete the plant layout.

Site preparation was under supervision of the Austin Company, engineers and constructors of Cleveland, Ohio, which cleared and graded the

FOR MORE TO WORK WITH ... WORK WITH HONEYWELL

For your mechanical systems...
Honeywell's New Two-Position Fluid Power Valve

It's silent and ⅓ smaller than ordinary

This new Electric Control Valve uses Fluid Power—an entirely new valve operating principle that produces two-position control in a smaller size. Operation is silent, with absolute freedom from maintenance or repair of the power unit. Because of the many exclusive new features of this Honeywell Fluid Power Valve, automatic control can now be applied where it has never before been possible or economically practical. This new valve is especially suitable for radiators, convectors and fan-coil units used for heating, cooling or year-round operation. And this new Honeywell Fluid Power Valve now makes modernization changeover to automatic control simple, inexpensive and trouble-free.

New V8025 Two-Position Fluid Power Electric Valve.

land, erected buildings, and installed piping. Design of the buildings and services was a joint effort between this firm and the Johns-Manville engineering department.

Jackson & Moreland Forms Subsidiary

To further its expanding Latin-American practice, Jackson & Moreland, Inc., Boston consulting engineering firm, has created a wholly owned subsidiary, Jackson & Moreland International, Inc. Oscar S. Bray, associated with the company since 1941, is president of the new organization; Hartley Rowe, former vice president and chief engineer of United Fruit Company, is chairman of the board.

Large Air Conditioned Auditorium

Completed at a cost of $6 million, the new white marble California Masonic Memorial Temple atop Nob Hill in San Francisco has the largest air conditioned auditorium in northern California. Designed by Dudley Deane and Associates, San Francisco consulting engineers, the air conditioning was installed after an economic study indicated that complete air conditioning would cost no more than adequate ventilation, which would not have offered temperature and humidity control. The semicircular auditorium seats 3200 persons.

The refrigeration equipment is divided into several increments of capacity – large for maximum load when the entire building is in use, and small for minimum load when only offices are being used. The selection of machines to match the cooling load is automatic.

Improvements for Port of New Orleans

The New Orleans Dock Board plans to borrow about $15 million this year in its long-range improvment and expansion program for the Port of New Orleans. Port Director Robert W. French announced that consultants probably would be retained to supplement the U.S. Army Corps of Engineers.

Welded Highway Bridges

Awards have been announced in a competition sponsored by The James F. Lincoln Arc Welding Foundation to determine the best welded bridge designs for the new interstate highway program. Designs were judged on the basis of economy of steel and labor, quality of detail, and appearance.

Farland C. Bundy and Charles S. Matlock, engineers with the Bridge Div., Texas Highway Department, Austin, Texas, received the $10,000 First Award for their twin-span 668-ft Buffalo Bayou Bridge in Houston, of all-welded continuous plate girder design.

C. Bridgefarmer, Douglas A. Nettleton, and

electric valves

QUIET—As quiet as the flow of the fluid itself. No whirring of motors or gear trains. No solenoid click. And the valve actually gets quieter with age.

SMALL—Because Honeywell's new Fluid Power Valve is 1/3 smaller than even the most compact of old-style electric-motor valves, it makes possible automatic control in tight places—places where automatic control has been impossible before.

RELIABLE—No moving parts to wear out. No oiling is necessary. Honeywell's new valve lasts for years and years, saves more than its original cost on service alone.

RUGGED—Stem-and-seat construction as in the best commercial valves. Closes tight, lasts a lifetime.

FAST—This new two-position valve goes from fully open to fully closed or back again in four seconds flat—1/5 the operating time of electric motor valves.

To control Honeywell's new valve, specify the world's most popular thermostat—the Honeywell Round. Neat, unobtrusive, its beauty reflects the watchlike accuracy with which it's made.

Honeywell

H First in Control

Two award-winning welded bridges. Above, box girder arch bridge on Dallas-Fort Worth Turnpike; and left, haunched girder Buffalo Bayou Bridge.

William L. Power, all of Dallas, Texas, received a $7500 Second Award for their design of an arch bridge on the Dallas-Fort Worth Turnpike. The 192-ft span with four welded box girder arch ribs is considered to be the first bridge of its type in this country. Dale C. Hoffman and Dwight H. Sparks, Columbus, Ohio, also received a second-place award for their four-span 398-ft haunched girder bridge. Three Third Awards of $5000 were shared by three design teams.

Membrane Fireproofing

An apartment building redesign using gypsum lath and plaster membrane fireproofing and steel frame construction, compared to an original reinforced concrete design proposal, will save $279,000 for the Public Housing Authority of East St. Louis, Ill.

Both designs were based on the same conditions; identical building configurations, live load floor requirements, ceiling heights, apartment layouts, and fire ratings. Consulting engineer is Joseph W. Goldenberg.

Part of a 500-home slum clearance project, the three 8-story, brick-faced apartments are to be located with 41 garden apartment buildings in a three-block area.

The original design was based on optimum reinforced concrete standards. The lighter weight steel

In a restaurant application, the Honeywell "Renew-Air" Filter has high absorption capacity for such objectionable odors as tobacco smoke, burning fat, fish and others likely to be present. In the past, increased outdoor air intake was necessary to diffuse these odors, which resulted in higher air conditioning costs. Now Honeywell's "Renew-Air" Filter removes the odors, enables air conditioning to be operated economically with reduced air intake.

frame membrane fireproofed lath and plaster redesign reduced foundation requirements by about 30 percent. Similarly, 30 percent fewer columns will be needed.

Three types of nonload bearing walls are provided: steel stud construction with gypsum lath and plaster on both sides in two types – with and without insulation between studs – and 2-in. solid gypsum lath and plaster.

Connecticut Turnpike Nears Completion

Connecticut highway officials announce that the Connecticut Turnpike's Riverside to Bryam River section has been completed on schedule. New York's Bryam River Bridge and the 15 miles of roadway from Port Chester to the Bronx is expected to be opened to traffic by mid-October, completing the final link between New York City and Rhode Island. The route will be 144-miles long and will cost over $555 million.

New S. Klein Department Store

Construction of a multimillion-dollar department store for S. Klein is under way on a 27½-acre site in the northeastern section of Yonkers, N.Y.

The main building will be a two-story structure and basement, containing 200,000 square feet of floor area and air conditioned throughout. The frame will be of reinforced concrete construction.

A one-story annex, a greenhouse, yard area with covered walks, and parking space for 3000 cars also are included in the plans.

Farkas & Baron are the structural engineers; Cosentini Associates are the mechanical engineers; and Kelly & Gruzen are the architects.

Dutch Affiliate for Stone & Webster

A Netherlands subsidiary for Stone & Webster Engineering Corp., with headquarters in The Hague, has been created and closer ties formed with British, French, and Australian subsidiaries.

The new Dutch affiliate will be known as Stone & Webster Engineering, N.V. In Britain, E. B. Badger & Sons, Ltd., founded in 1938 and merged with Stone & Webster in 1951, becomes Stone & Webster Engineering, Ltd. The French subsidiary Etablissements Badger, S.A. is now Stone & Webster Engineering, S.A. E.B. Badger & Sons Pty., Ltd, of Australia, becomes Stone & Webster Pty., Ltd.

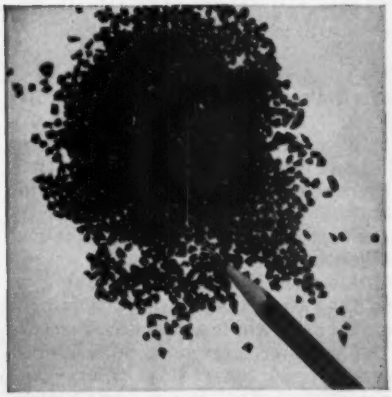
Other international companies are Stone & Webster Canada, Ltd, and Stone & Webster Construction Co., operating in Central and South America.

New Apartment Development in Los Angeles

When completed, Los Angeles' Barrington Plaza, planned and designed by Daniel, Mann, Johnson

For your mechanical systems... Honeywell's "Renew-Air" Filters

Their activated charcoal removes odors, lowers air conditioning cost!



Only the best activated charcoal is used in Honeywell's "Renew-Air" Filters. This charcoal, made from coconut shells, has more pores, more area for absorption. (Roughly, 125 acres per pound.) It is hard and durable, does not dust off or powder in service.

Here's a better, more economical solution to the problem of odors than either masking or diffusion. This new Honeywell Air Filter uses the principle of absorption by activated charcoal to filter return air, reduce the amount of intake air needed and produce savings in air conditioning installation and operating costs.

Combined with the Honeywell Electronic Air Cleaner, this new Air Filter provides air with the highest level of purity and cleanliness possible. Restaurants, hospitals and factories are only a few of the applications where this result is desired.

For convenience in specifying and installing, the Honeywell "Renew-Air" Filter is available in four different sizes and types of cells. These cells are easily removable from the frame for re-activation which Honeywell does at low cost. For further information, contact your local Honeywell office or write Minneapolis-Honeywell, Dept. CO-9-49-9, Minneapolis 8, Minnesota.

Honeywell

First in Control

Artist's rendering of Barrington Plaza, to be tallest apartment project in southern California.

& Mendenhall, architects and engineers, will be the tallest multistory apartment development in southern California. It also will be the first urban renewal project in the Los Angeles area totally financed by private enterprise.

The project will be located at Wilshire Boulevard in West Los Angeles. This site was selected because of nearby industry, availability of public transportation, and proximity to recreational and cultural facilities.

Engineers Needed

Dr. C. C. Furnas, chancellor of the University of Buffalo, has told Congress that the U. S. needs more and more engineers and scientists if America is to maintain an adequate economic and military status during the next decade.

Testifying before the House Government Operations Committee, Furnas declared it is not sufficient to produce a certain number of engineers and scientists, for numbers alone will not solve the problem. Careful attention must be given to the quality of the engineers and scientists. And there must be adequate support from industry and government for their continuing professional activities.

An analysis of the relative positions in scientific education and manpower of the U. S. and Russia, made by Dr. Raymond Ewell, vice chancellor of the University of Buffalo, shows:

"The actual number of trained scientists and engineers on duty at the present time is much higher in the U. S. than in Russia – about 900,000 scientists and engineers in the U. S.; probably not over 500,000 in Russia. However, Russia is producing engineers at a much higher rate than the U. S. al-

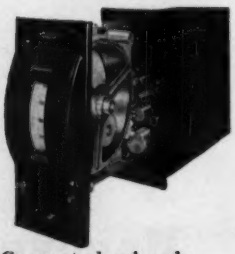
Unlimited remote temperature readings on one Honeywell Electronik* indicator

Scale shown full size. Twin hairline index prevents parallax errors.

With this new, compact indicator, the operating engineer can read temperatures at any point in an air conditioning system simply by pressing a button.

And he gets the most accurate readings known. Honeywell's indicator is accurate to plus or minus 1/5 of a degree because it's electronically precise and its rotating vertical scale—over 28 inches long—gives more than twice the indication area of ordinary circular indicators.

Private offices, zones on each floor, outside air, chilled or hot water lines all can be checked instantly on this one instrument in less than a square foot of panel space. Since sensing elements for the indicator are located right in the thermostat, connected to the indicator by low voltage wiring, there's no need for dual installation.

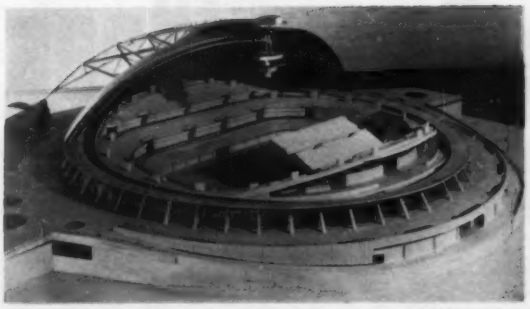


Compact chassis only 6½" wide. Slides out for inspection without stopping operation of indicator. *Trademark

At little extra cost, a Honeywell Systems Analyzer can be added when desired. Using the same wiring and sensing elements as the indicator, it records, on a 12-inch wide strip chart, the readings for any point or combination of points, provides a permanent record.

Honeywell

First in Control



Indoor-outdoor stadium to be built in Pittsburgh features movable stainless steel dome. Left, as enclosed auditorium; above, as open-air arena.

though the U. S. currently is producing more scientists than Russia. The U. S. is producing about 25,000 engineers a year; Russia 75,000."

Convertible Stadium for Pittsburgh

Pittsburgh's new Civic Arena will be roofed with a retractable 415-ft diameter stainless steel dome, the first of its kind ever built. The $20-million structure can be converted from an open stadium to a completely enclosed auditorium. It will feature a versatile seating arrangement to accommodate up to 14,000 people.

The retractable roof will consist of eight sections — six movable and two stationary. When the roof is retracted, the six movable sections, three on each side, will roll over the two fixed sections. Ammann & Whitney, New York City consulting engineers, designed the dome.

The Civic Arena is part of the city's Lower Hill Redevelopment which is to transform into a cultural showplace nearly 100 acres of slum area at the upper end of the Golden Triangle. The Arena, including the mall and parking area, will occupy about 20 acres. ▲▲

Major Oil Company SPECIFIED THERMAL

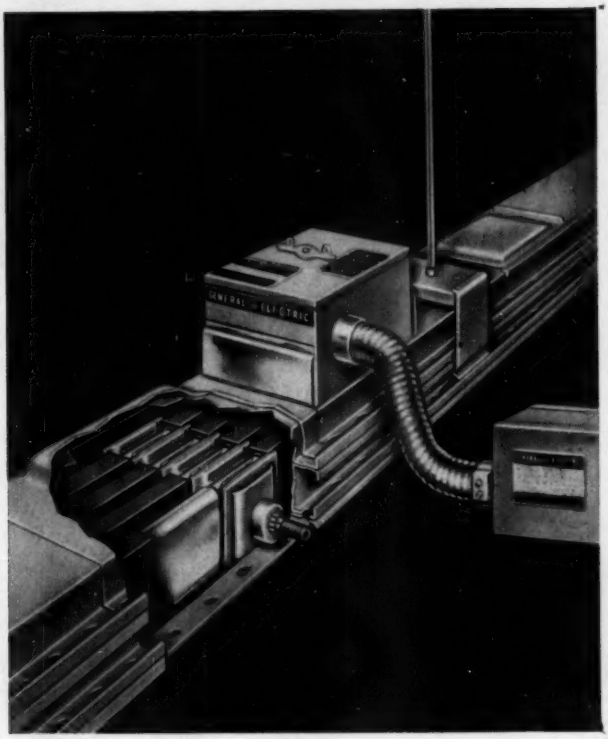
Two big Thermal central plant units were specified by a major oil company with headquarters in Houston for the year-round air conditioning of its Data Processing System. This same company has many other installations of Thermal air conditioning equipment in its several plants and office facilities.

The Thermal line includes central plant air conditioners; multi-zone air conditioners, sprayed coil units; heating and ventilating units, cooling and heating coils and air-cooled condensers. For air conditioning and ventilating equipment that can be relied on for efficiency, long life and economical operation, see your Thermal Engineering agent.

Agents in principal cities.
Quality Products Since 1945.

THERMAL ENGINEERING CORPORATION
2605 W. DALLAS • P. O. BOX 13254
HOUSTON 19, TEXAS

4 new ideas in power distrib



New Switchboard

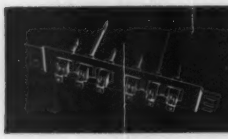
For 600-volt, maximum service, 50-100,000-ampere short circuit rating

Standardization is the keynote in this new Type DR switchboard. Standardization provides greater flexibility, easier installation and more maintenance features than ever before—*at lower total cost.*

Standardization, for example, enables the DR to incorporate any combination of seven protective devices—fusible or circuit breaker types—with complete interchangeability.

Standardization allows units or whole sections to be added, interchanged or removed—quickly, easily—in the field, as load conditions change, and with minimum time and effort. Pre-drilled, pre-formed modular framework and bus bars virtually eliminate the need for field drilling.

For installation and maintenance ease, standardized, centrally located horizontal main busing leaves the top and bottom of the DR clear for busway or cable entrance. No braces or bars to interfere with wiring. All terminals are easily accessible. Ask for a copy of Bulletin GEA-6627.



DR SWITCHBOARD EXTRA VALUE
New stud assembly. Eliminates wire bending—allows "straight-in" wiring—opens up more working space to speed installation. Stud assemblies are mounted on a strong, light-weight, non-magnetic aluminum barrier which minimizes heating.

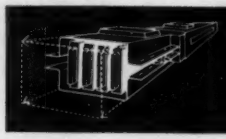
New Busway

ampere for ampere, the smallest, lightest, most efficient and rugged ever designed

New Type DE busway is a totally enclosed plug-in busway with 50,000-ampere short circuit capacity as standard. It is rated 225-1000 amperes, 600 volts maximum, 3 pole or 4 wire, 3 phase. New Type DE busway incorporates all 22 features that engineers, contractors and users say are important in busway design.

DE, for example, installs with unmatched ease. It is up to 50% lighter and 30% smaller than other busways of comparable rating; approved for hanging on 10-foot centers in any position. Sections are electrically joined—quickly, simply—by means of a unique one-bolt, vise-like mechanism that maintains positive electrical contact between conductors with a ton of force. And DE's miniaturized fittings virtually eliminate the need for custom engineering. Result: 30% average saving in installation cost and 10% over-all.

For flexibility, twelve plug outlets come in each 10-foot length. For extra safety, each outlet is virtually dead-front and traveling arcs are essentially eliminated—thanks to Butyl insulation which is extruded over the full length of each bus bar, overhanging bus plug openings. Ask for a copy of Bulletin GEA-6173.



DE BUSWAY EXTRA VALUE
DE busway's telescoping length allows one-foot adjustment (between 36 and 48 inches), precluding need for exacting layout, custom engineering, or special fabrication.

OPERATION up turn
Buy now for extra values
GENERAL ELECTRIC

See your G-E representative or distributor for complete information. You may also obtain complete information on this equipment by writing to General Electric Company, Distribution Assemblies Department, Plainville, Conn.

ution offer more for the money

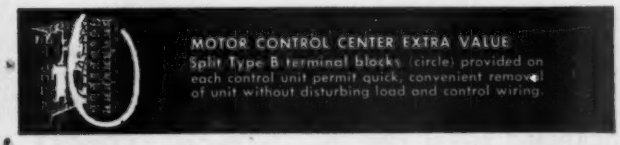
New Control Center

conserves space, costs less to install, saves money in operation

New compact Type DA7093 Motor Control Center provides an economical, centralized control of A-C motors, up to 200 hp at 600 volts (100 hp at 240 volts).

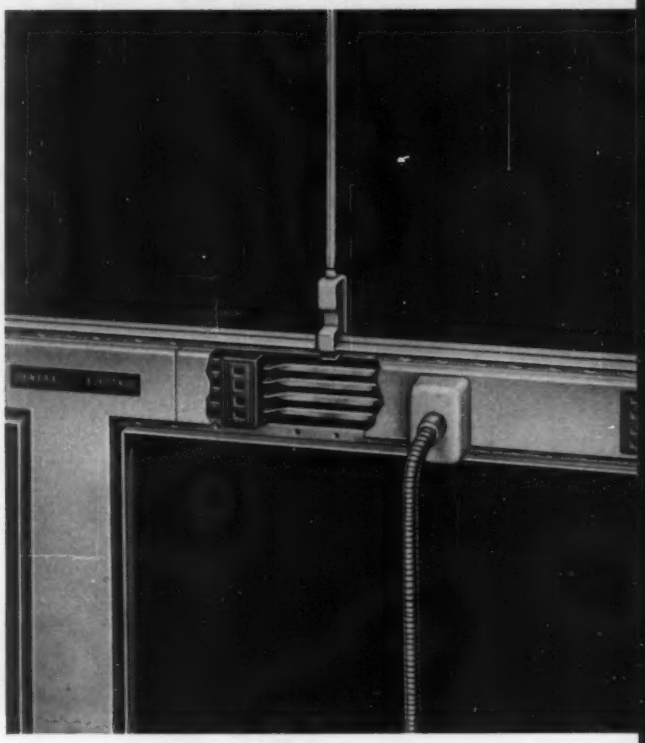
Compared with individual motor control, initial equipment investment with Type DA7093 is usually substantially lower. At the same time, the '93 affords convenient, economical plant operation and low maintenance. And when load requirements change, the '93 is easily expanded to meet them with standardized plug-in control units in NEMA sizes 1 through 5. Other components, such as meters, instruments, relays and panelboards can be built-in to meet specific needs.

Location of main buses at center of section allows wide, unobstructed pull-box space at top and bottom for easy wiring. Bus bars are silver-plated for positive electrical contact and edgewise mounted for optimum short circuit strength. Standard main bus ratings are 600 or 1200 amperes. Bus bars are braced for fault levels of 25,000 or 50,000 amperes. Ask for Bulletin GEA-6367A.



MOTOR CONTROL CENTER EXTRA VALUE

Split Type B terminal blocks (circle) provided on each control unit permit quick, convenient removal of unit without disturbing load and control wiring.



New Busway

100-ampere plug-in design hailed as the "Wiring Method of Tomorrow"

Now, a plug-in busway that costs no more installed—and usually substantially less—than wire and conduit!

Or as a leading electrical contractor in Wilmington, Delaware, puts it: "With Type DH, I can save 25% over the cost of conduit and wire when there are four or more tap-offs in the system."

Type DH—rated 100 amperes, 3 pole or 4 wire, 3 phase, 600 volts maximum—serves as either a feeder or plug-in system and may be used wherever exposed wire and conduit might be applied. Light, sturdy and small in size (in cross-section not much larger than a pack of king-sized cigarettes), DH may be hung edgewise on 10-foot centers. Eighteen dead-front outlets are provided in each 10-foot length. For added flexibility, each outlet accepts a variety of fusible, no-fuse and circuit breaker plugs.

G-E distributors, *nationwide*, stock Type DH, including its wide variety of fittings and accessories. So DH matches wire and conduit in *availability* as well as cost. Ask for Bulletin GEA-6172.

DH BUSWAY EXTRA VALUE

Telescoping length adjusts between 42 and 54 inches. This, plus flexible fittings, eliminates need for exact measurements. Rigid fittings—elbows, crosses and tees—adapt busway to virtually any building contour.

GENERAL ELECTRIC

Design a 2-lane steel bridge to cross a modern

AMERICAN BRIDGE DIVISION of United States Steel announces a $44,000 STEEL HIGHWAY BRIDGE DESIGN COMPETITION dedicated to stimulating the engineering mind to a more imaginative, more effective use of steel in the construction of small bridges.

If you, as a professional or design engineer or as a college engineering student, can come up with a more imaginative, attractive and economical design, not only may you win up to $15,000 in award money, but your efforts may contribute materially to the most challenging road-building program ever undertaken. For, according to conservative estimates, the tremendous 41,000-mile Federal Highway Program will call for the construction of at least a bridge a mile!

The competition involves solving a relatively simple but important problem that will not demand too much of your time.

PROBLEM: Get two lanes of traffic across a modern 4-lane highway, in accordance with the standards for today's highways.

OBJECTIVES: Originality of design, greater utilization of the inherent properties of steel, economy, and aesthetic appeal.

REQUIREMENTS: Just one. The steel bridge must comply with the Geometric Standards for the National System of Interstate and Defense Highways using H-20-S16-44 loading. The type of structure, the type of connections, span length and number of piers, if any, are completely up to you since you are designing with steel.

ELIGIBILITY: The competition is open to all professional and design engineers and college engineering students except employees and/or members, and their immediate families, of the following firms and groups:

- United States Steel and its subsidiaries, divisions, agents and dealers
- Structural steel fabricating firms
- American Institute of Steel Construction members
- Rules Committee and Judges

See list of awards at right.

RULES AND JUDGING: The competition will be under the supervision of the American Institute of Steel Construction, which has appointed a Rules Committee and a panel of judges composed of prominent consulting engineers and architects.

DEADLINE: May 31, 1959.

SEND FOR YOUR ENTRY BOOKLET NOW: Contains complete information on the Steel Highway Bridge Design Competition—everything you need to know to prepare your entry. Just fill in and mail the coupon and get started with your design without delay.

USS is a registered trademark

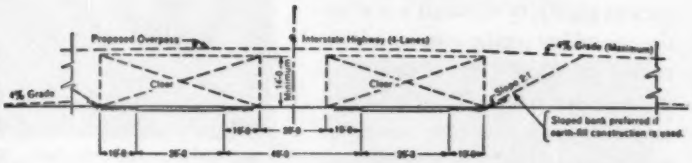
highway... $44,000 in cash awards!

Awards for Professional Engineers

1st Award	$15,000.00
1st Honorable Mention	$10,000.00
2nd Honorable Mention	$ 5,000.00
Five 3rd Honorable Mentions	$1,000.00 each

Awards for College Engineering Students

1st Award	$4,000.00
1st Honorable Mention	$2,000.00
2nd Honorable Mention	$1,000.00
Four 3rd Honorable Mentions	$500.00 each



ELEVATION and CLEARANCE DIAGRAM

American Bridge Division of United States Steel

General Offices: 525 William Penn Place, Pittsburgh, Pa.

Competition Editor, Room 1831, American Bridge Division
525 William Penn Place, Pittsburgh, Pennsylvania

Please send me a copy of your $44,000 Steel Highway Bridge Design Competition entry booklet.

Name.....

Professional or Design Engineer / Engineering Student } (Check one).....

Address.....

City.....State.....

Underground hot pipes stay free from trouble...when you INSULATE WITH GILSULATE

One of the most difficult problems in designing underground hot piping systems is providing positive corrosion protection against electrolytic, chemical or galvanic attack. The answer lies in the use of GILSULATE. For, in addition to its excellent insulating properties, this naturally-occurring hydrocarbon is chemically neutral in all soils, dielectric, and moisture-proof and water-proof as well.

GILSULATE's low thermal conductivity, low cost and easy installation make it possible for schools, colleges, housing projects, hospitals, industrial plants and other institutions to install central heating with underground piping and to realize the savings in equipment and operating costs which such systems provide.

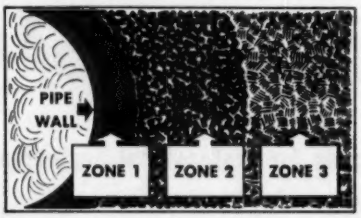
We'll help you with your plans

If you are planning to rehabilitate present piping, or to install a new underground hot piping system, call the nearest GILSULATE Distributor listed on the page opposite this advertisement. His own extensive experience in heating and air conditioning, plus the research, engineering and field supervision facilities of the American Gilsonite Company are at your disposal...without obligation. They will work with your engineers in checking specifications, unusual soil conditions, and actual installation to make sure that the finished job is completely satisfactory.

If you would like complete information on GILSULATE insulation, or would like to be put on the mailing list to regularly receive free copies of PIPE INSULATION NEWS, send your request to any of our offices.

GILSULATE IS EASY AND ECONOMICAL TO USE

GILSULATE completely frees you of the expensive, time-consuming preparation required by many insulating systems. You just pour it into the pipe trench, shovel-point it around the pipes, and tamp it. Pipe heat does the rest.



Heat fuses the GILSULATE to pipes and joints to form three zones: Zone 1, a flexible, heavy-duty water barrier; Zone 2, of firmly-cemented granular GILSULATE that provides excellent thermal insulation under wet or dry conditions; and Zone 3, which provides a final zone of thermal insulation and a support for the water-proof structure.

GILSULATE®

TRIPLE ZONE INSULATION
FOR UNDERGROUND HOT PIPES

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Affiliate of Barber Oil Corp. & Standard Oil Co. of Calif.
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GILSULATE's unique properties

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Lowell & Terre Haute
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KENTUCKY
Jackson Engineering Co., Inc.,
660 S. 5th St., Louisville 2
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Edgar Murray Supply Co., Inc.,
232 Canal St., New Orleans 6
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Freemire & Associates, Inc.,
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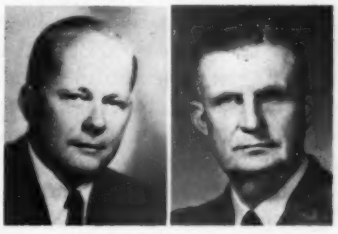
Men in Engineering

Russell P. Westerhoff, a vice president of Ford, Bacon & Davis, Inc., New York firm of management consultants and engineers, has been named to a two-year term as a director of the National Society of Professional Engineers, to represent the New Jersey Society of Professional Engineers.



WESTERHOFF CREASY

Major General William M. Creasy, upon retirement as Chief Chemical Officer of the U.S. Army this month, will join The Lummus Company, engineers and constructors of New York City. General Creasy will be a vice president of the firm and serve as director of The Lummus Engineering Development Center.

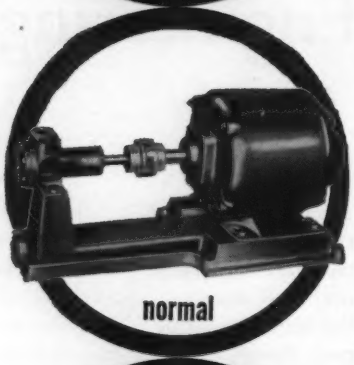
Rutherford L. Stinard, P. E., has moved his office to 801 Second Ave., New York 17, N.Y.

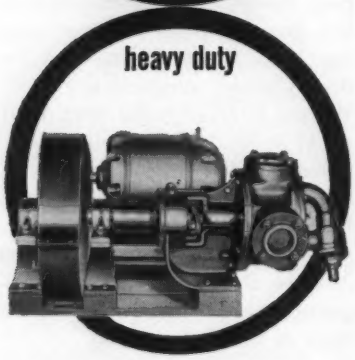
Stanley Engineering Company, consulting engineers of Muscatine, Iowa and Chicago, Ill., announce the following organizational changes: Sanford K. Fosholt, partner, has assumed supervision of the firm's operating units – the report, design, construction, and office groups; Bruce L. Sturdevant has been appointed head of the design group, succeeding Fosholt; Willard R. Sheldon has been designated as head of the building and industrial department in the design group; Murray W. Sedgley has become head of the civil department of the design group; and Thomas D. Wenger has been appointed head of the power department of the design group.

STURDEVANT FOSHOLT

B. A. "Mac" McAdams has been appointed project manager for sanitary engineering projects at Rader and Associates' St. Petersburg office. McAdams will assist Edward R. Lampp, manager of the West Coast office, with the engineering

What job do you have for a VIKING PUMP?





Sizes From 2/3 to 1050 G. P. M. Capacities

There is a Viking positive displacement pump for most industrial pumping requirements . . . probably yours. If you need fast, self-priming along with positive, smooth delivery, Viking Pumps are your answer — whether liquids are thin or thick.

In the Viking Pump line there are 750 cataloged models in 20 sizes, with additional thousands of specially built pumps available. This wide selection assures you of the right pump to fit your needs.

So, install Viking Pumps! Save space; Save dollars! Save installation and operating time! And let one of the simple Viking "gear-within-a-gear" pumps do your job the way you want it done.

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VIKING PUMP COMPANY

Cedar Falls, Iowa, U.S.A.
In Canada, it's "ROTO-KING" Pumps
See Our Catalog in
Industrial Construction and Plant Engineer's File

design and supervision of construction of the many water, sewerage, and gas systems being planned.

Dr. Mervin J. Kelly, president of Bell Telephone Laboratories, will be the 1959 recipient of the John Fritz Medal for "his achievements in electronics, leadership of a great industrial research laboratory, and contributions to the defense of the country through science and technology." The John Fritz Medal is sponsored jointly by the American Society of Civil Engineers, the American Institute of Mining, Metallurgical and Petroleum Engineers, The American Society of Mechanical Engineers, and the American Institute of Electrical Engineers.

General Industries Incorporated, Engineers, have moved their offices to 1225 Vine St., Philadelphia 7, Pennsylvania.

W. O. Richmond, P.E., of Vancouver, B.C., is the newly elected president of the Canadian Council of Professional Engineers. Richmond is the immediate past president of the Association of Professional Engineers of British Columbia and head of the Department of Mechanical Engineering of the University of British Columbia.

Vice president is D. O. Turnbull, P.E., president of the Association of Professional Engineers of New Brunswick; executive member is N. S. Bubbis, P.E., immediate past president of the Association of Professional Engineers; and secretary-treasurer is Leopold M. Nadeau, P.E., of Montreal and Ottawa.

T. Cortlandt Williams, president of Stone & Webster Engineering Corp., has been elected as a member of the board of trustees of Bucknell University in Lewisburg, Pa. He was elected for a 5-year term as representative of the Bucknell Alumni Association.

John W. Maloney and Richard C. McGowan have been admitted as partners in the firm of Dames & Moore, Soil Mechanics Engineers, of Los Angeles, Calif. Maloney has been assigned to the New York office and McGowan is in the general offices of the firm in Los Angeles, Calif.

MCGOWAN MALONEY

C. H. Gronquist, associate engineer with D. B. Steinman, Consulting Engineer, New York, received the honorary degree of Doctor of Science from his alma mater, Rutgers University. The degree was conferred in recognition for his work on the design and supervision of construction of many major bridges in the U. S.

Thomas H. Hablett, Professional Engineer, has moved his offices to 4 Lindenwold Terrace, Ambler, Pa. Hablett formerly was located in Philadelphia.

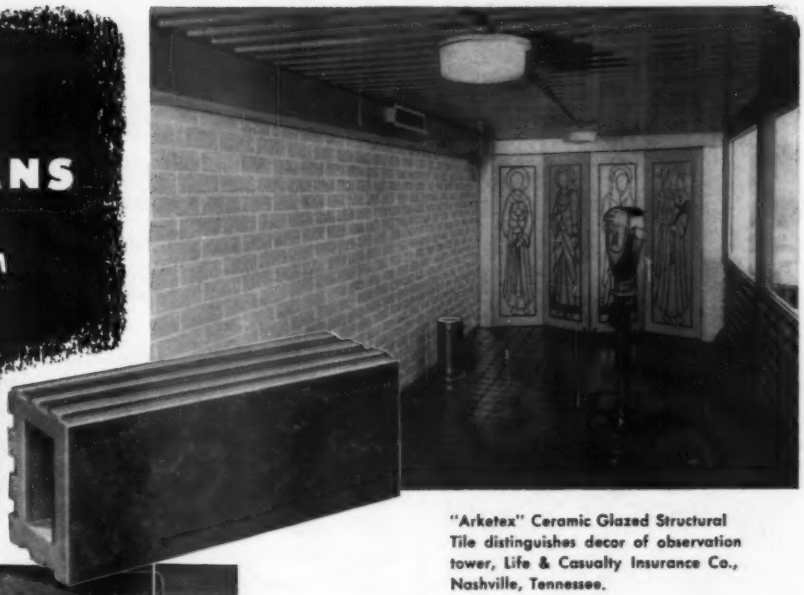
The de Florez Company, Inc., formerly of New York City, has moved to new quarters at 200 Sylvan Ave. (Route 9W), Englewood Cliffs, N.J.

Register & Cummings, engineers of Jacksonville, Fla., have moved to new offices located at 637 Park Street, Jacksonville.

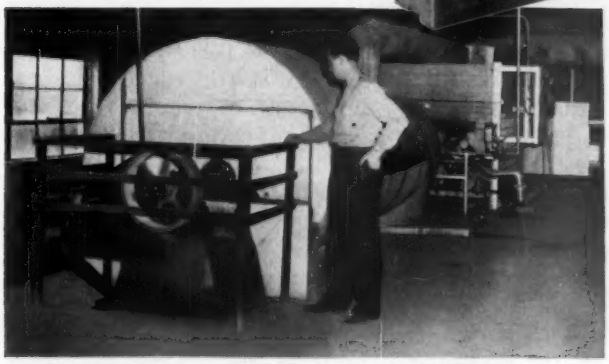
H. E. Bovay, Jr., Consulting Engineers of Houston, Texas, announce the following organizational changes: Bennett W. Burns, partner, assumes the duties of managing partner, Houston; S. J. Bell, associate, has taken up Burns' former duties as chief engineer, Houston; Guy Furgiuele, associate, be-

HOW Bayley FANS

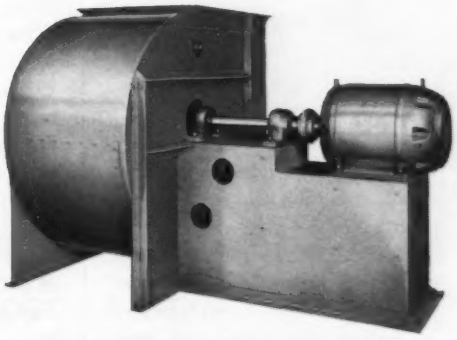
RECIRCULATE WARM AIR FOR DRYING Arketex CERAMIC GLAZED STRUCTURAL TILE



"Arketex" Ceramic Glazed Structural Tile distinguishes decor of observation tower, Life & Casualty Insurance Co., Nashville, Tennessee.



Bayley Fans recirculate warm air for clay products dryers in plant of Arketex Ceramic Corp.



Bayley 445 Fan similar to type employed in "Arketex" ceramics plant.

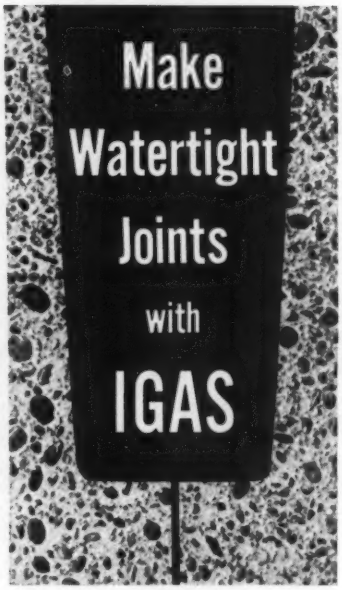
IN the progressive-type dryer required for drying the high quality ceramic glazed structural tile produced by the makers of "Arketex," it is essential to properly control both temperature and humidity. A battery of six Bayley Fans are employed in the modern plant of Arketex Ceramic Corporation, Brazil, Indiana, for re-circulating warm air in clay products dryer.

Choice of Bayley Fans for this process at "Arketex" is a reflection of confidence on the part of both dryer designer and the purchaser in the efficiency of Bayley equipment. You may always rely upon Bayley specialists to recommend the right answer to your air-handling requirements.

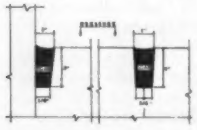
Illustrated Bulletins upon request.

Bayley BLOWER COMPANY

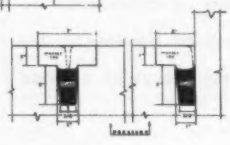
6610 W. Burnham St. Milwaukee, Wisconsin



Igas Joint Sealer is a non-meltable, mastic waterstop that is easily applied to joints after the concrete has hardened. Igas will not dry out or become brittle when subjected to climatic changes. It can be placed in vertical, horizontal and overhead joints, thus forming an effective, watertight seal. Igas is ideal for foundations, basements, swimming pools, tunnels, etc. For complete information about Igas, write for Bulletin IS-56.



Water Reservoirs
Tanks
Parking Decks



Basements
Tunnels
Retaining
Walls

Sika SIKA CHEMICAL CORPORATION
PASSAIC, NEW JERSEY

DISTRICT OFFICES: ATLANTA • BOSTON • CHICAGO • DALLAS • DETROIT • NEW ORLEANS • PHILADELPHIA • PITTSBURGH • SALT LAKE CITY • WASHINGTON—DEALERS IN PRINCIPAL CITIES—AFFILIATES AROUND THE WORLD

comes assistant chief engineer, Houston; L. S. Curtis has been made an associate of the firm and assistant to Bovay; and Morris Backer succeeds Furgiuele as head of the air conditioning and plumbing design divisions.

Castellucci & Galli, Inc. have moved their offices to 75 Empire St., Providence, R. I.

The world-wide headquarters of The Ralph M. Parsons Company, engineers-constructors, have been moved to 617 West Seventh St., Los Angeles, Calif. The move consolidated over 1000 administrative and engineering personnel into a single building, with the remaining Parsons' Los Angeles office staff in the Oviatt Building at 617 South Olive Street.

Parsons' New York office moved to larger quarters in the Seagram Building, 375 Park Ave., earlier this year, and the last of three moves took place in France, where Parsons' office was moved to 41 Avenue George V, Paris 8.

Joseph M. DeSalvo, chief engineer of Joseph S. Ward, Inc., consulting engineers of Caldwell, N. J., has been elected a vice president of the firm.

Formation of the firm Magadini & Niebur, Consulting Structural Engineers, has been announced. Principals of the firm are Charles R. Magadini and Robert G. Niebur. Offices are at 1401 East Camelback Road, Phoenix, Ariz.

Don Stoops, former deputy director of the U. S. Operations Mission to Panama, has been named vice president of Latin American operations for George Fry & Associates International, Ltd., according to William J. Biehl, president of the Chicago-New York-Los Angeles management consulting firm.

Stoops also has been named resident manager of the parent firm's Washington office. He will direct Latin American consulting assignments from new offices of the Fry international affiliate to be established in Mexico City and Caracas.

STOOPS TENG

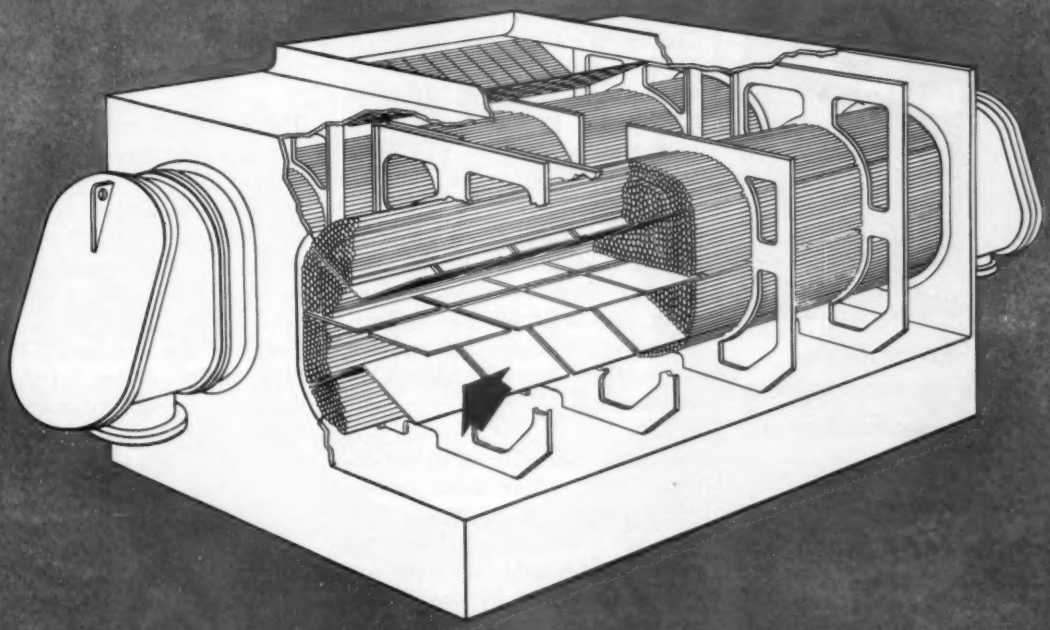
Dr. Wayne Teng has become the head of the structural department of John F. Meissner Engineers, Inc., of Chicago, Ill. Dr. Teng formerly was on the faculty of the Illinois Institute of Technology and assistant chief structural engineer for Skidmore, Owings & Merrill.

Richard Hill Associates, Consulting Engineers, have moved their offices to 404 Fourth Ave., New York 16, N. Y.

General Nuclear Engineering Corp., of Dunedin, Fla., has added four nuclear engineers to their technical staff. They are: William F. Dougherty, Jr., former section manager of the nuclear instrumentation department of the Allen B. Du Mont Laboratories; Karl R. Goller, formerly associated with Babcock & Wilcox, Lynchburg, Va.; George W. Rivenbark, formerly associated with Oak Ridge National Laboratory; and George M. Roy, former manager of the nuclear engineering unit, General Electric Co., Atomic Power Equipment Department, San Jose, Calif.

Michael Baker, Jr., president of Michael Baker, Jr., Inc., Rochester, Pa., consulting firm has received a Distinguished Alumnus Award from Pennsylvania State University. The university gives the award to recognize achievements of outstanding alumni. It is made annually to

unique location of condensate removal trays produces most effective deaeration and higher vacuum



Another Big Difference in

ROSS SURFACE CONDENSERS

Innovations in Ross Surface Condenser design are numerous. Each provides distinct advantages.

Arrangement of the condensate trays in the 110,000 sq. ft. unit illustrated is a noteworthy example. They perform a triple service:

1 By spilling the condensate into the live steam transportation area, the trays promote effective deaeration in the main shell. Droplets are thoroughly scrubbed with live steam. Entrained non-condensibles are then released and swept into the air removal section.

2 As a result of their converging pattern, the trays maintain vigorous steam velocities for scavenging non-condensibles.

3 By reason of the trays' effective draining action, water-blanketing or flooding of the tubes is minimized. *All* tube surface in the bundle therefore condenses steam at top efficiency, with uniform heat transfer over the entire bank.

Keep your eye on the Ross design. It's packed with benefits found in no other condenser. Discuss them with a Company representative at your convenience . . . and request Bulletin 8.2K1 now.

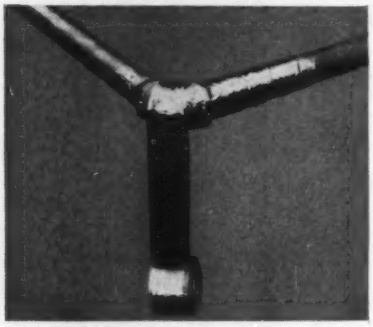
American-Standard*, Ross Heat Exchanger Division, Buffalo 5, N. Y. In Canada: American-Standard Products (Canada) Limited, Station D, Toronto, Ont.

*American-Standard and Standard ® are trademarks of American Radiator & Standard Sanitary Corporation.

AMERICAN-Standard

ROSS HEAT EXCHANGER DIVISION

For True Economy...
MEASURE PIPE PROTECTION WITH A CALENDAR!



Why Engineers Specify TAPECOAT ...The Quality Coal Tar Protection in Handy Tape Form for

Pipe	Tanks
Pipe Joints	Insulated Lines
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. . . in underground or under-water service

Since 1941, TAPECOAT coal tar coating in tape form has proved itself the best possible protection at lowest possible cost. Pipe and other surfaces TAPECOATED 17 years ago show no signs of deterioration—a record unmatched by any other type of tape.

Field application costs are lower with TAPECOAT because it is so easy to apply with the use of a torch. No tar kettles, technical know-how or special crews are required. TAPECOAT comes in rolls of 2″, 3″, 4″, 6″, 18″ and 24″ widths—sized to the job.

A TAPECOAT sales and service engineer is available at all times to assist you on any corrosion problem and on the various applications of TAPECOAT.

Write for illustrated brochure.

The **TAPECOAT** *Company*

Originators of Coal Tar Coating in Tape Form

1569 Lyons Street
Evanston, Illinois

Representatives in Principal Cities

former students who, through their personal lives, professional achievements, and community service, exemplify the objectives of the university.

M. J. Greene Co., Inc., Pittsburgh, Pa., announces the opening of branch offices in Erie and York, Pa. Charles W. Fiero has been appointed district manager of the Erie office located at 3716 West Lake Road; Ernest A. Gomm is district manager of the York office at 11 East Market Street.

Guy Kelcey, partner in the Newark firm of Edwards and Kelcey, consulting engineers, received the honorary degree of Doctor of Engineering at the 42nd commencement exercises of Newark College of Engineering.

Vincent C. Aderente, electrical engineer with Albert Kahn Associated Architects & Engineers, Detroit, has been named winner from among eight entrants in a statewide contest sponsored by the Illuminating Engineering Society of Michigan. The contest was conducted to select the outstanding lighting project of 1957 designed by a member of IES.

Aderente's presentation described the lighting of the Undergraduate Library at the University of Michigan, with emphasis on the main lobby, general reading and study areas, and the multipurpose room. Keynote of the design centered on providing better than conventional lighting intensity coupled with low brightness to afford the thousands of daily students a place for study and research without eyestrain and consequent physical fatigue.

George S. Gatter, former Planning and Urban Renewal director for Monterey, California, has been appointed assistant director of the City and Regional Planning Division of Wilsey and Ham Engineers and Planners, Millbrae, California. He will serve under Abraam Krushkhov, Planning Division director. Gatter's appointment is the result of expanded city and regional planning services being undertaken by the firm.

H. N. Roberts & Associates, Consulting Engineers, at 3218 34th Street, Lubbock, Texas, now will be called Hicks & Ragland. The firm continues at the same address.

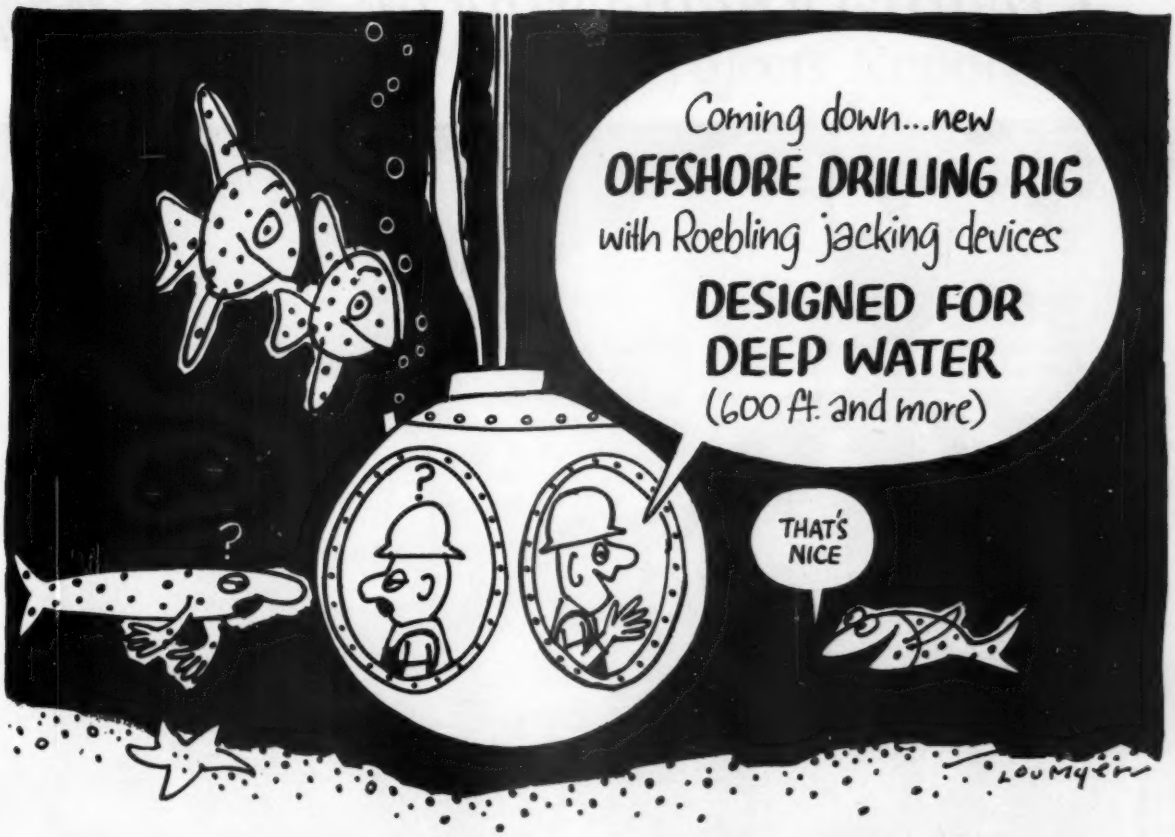
The firm of Morris and Van Wormer has been dissolved by mutual consent of the partners. A new firm has been established at the same address under the title of Charles H. Morris, Professional Engineer, 25 Broad Street, New York 4, N.Y.

Fred E. Hoffmanns has joined J. M. Little and Associates, industrial designers and consulting engineers of Maumee, Ohio, as the director of engineering.

HOFFMANNS ARMACOST

Wilbur Hering Armacost, vice president-consultant and chairman of the technical committee at Combustion Engineering, Inc., New York, has been awarded the American Society of Mechanical Engineers Medal for distinguished service in engineering and science. The ASME Medal is one of the highest honors the Society bestows.

James D. Ghesquiere was recently named vice president in charge of Engineering for the Hinchman Corp., Detroit corrosion control specialists. Ghesquiere was formerly Chief Engineer for the firm. David R. Loheit has joined the firm as administrative assistant. ▲▲



Expressly designed for deepwater locations, this equipment enables drilling where present types cannot operate.

The rig (Figure A) is towed to the drilling site in a buoyant condition, with both the anchor and deck float dewatered. At the drilling site, the anchor is gradually filled with water and lowered to the bottom by the jacking equipment. Once at the ocean floor, the anchor is completely filled with water, firmly seating it on the bottom.

While this operation is in progress, the buoyant float (Figure A) remains on the surface. Once the anchor is seated on the bottom, the Roebling jacking equipment goes into operation to bring the deck float down to operating position, which is at a predetermined level below the area wave action (Figure B).

When the drilling rig is to be moved to another area, the jack action is reversed. Strand is released to raise the deck float to the surface. The anchor float is pumped out sufficiently to permit the jacks to raise it to traveling position, under the deck float. During all of these raising and lowering operations, the strand is spooled up and payed off by means of power operated storage reels.

This is another example of how Roebling suspension systems and their principles can be—and are constantly—applied in the unlikeliest of places. Roebling's design, construction and service abilities range far and wide, embracing pipe line bridges, material and personnel tramways, ski lifts, guyed towers, suspended roofs and *suspension systems of all kinds*. The experience and knowledge gained from these activities prompts us to invite inquiries on any suspension project. Bridge Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

FIG. A

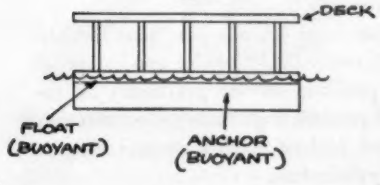
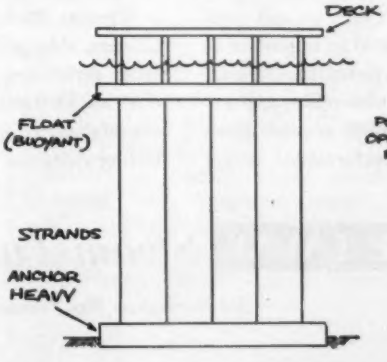
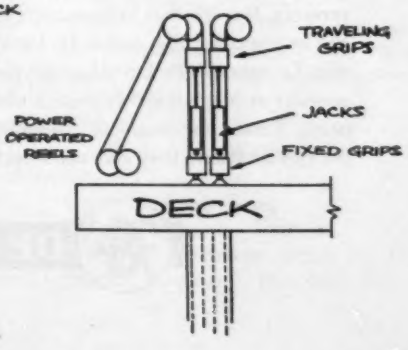
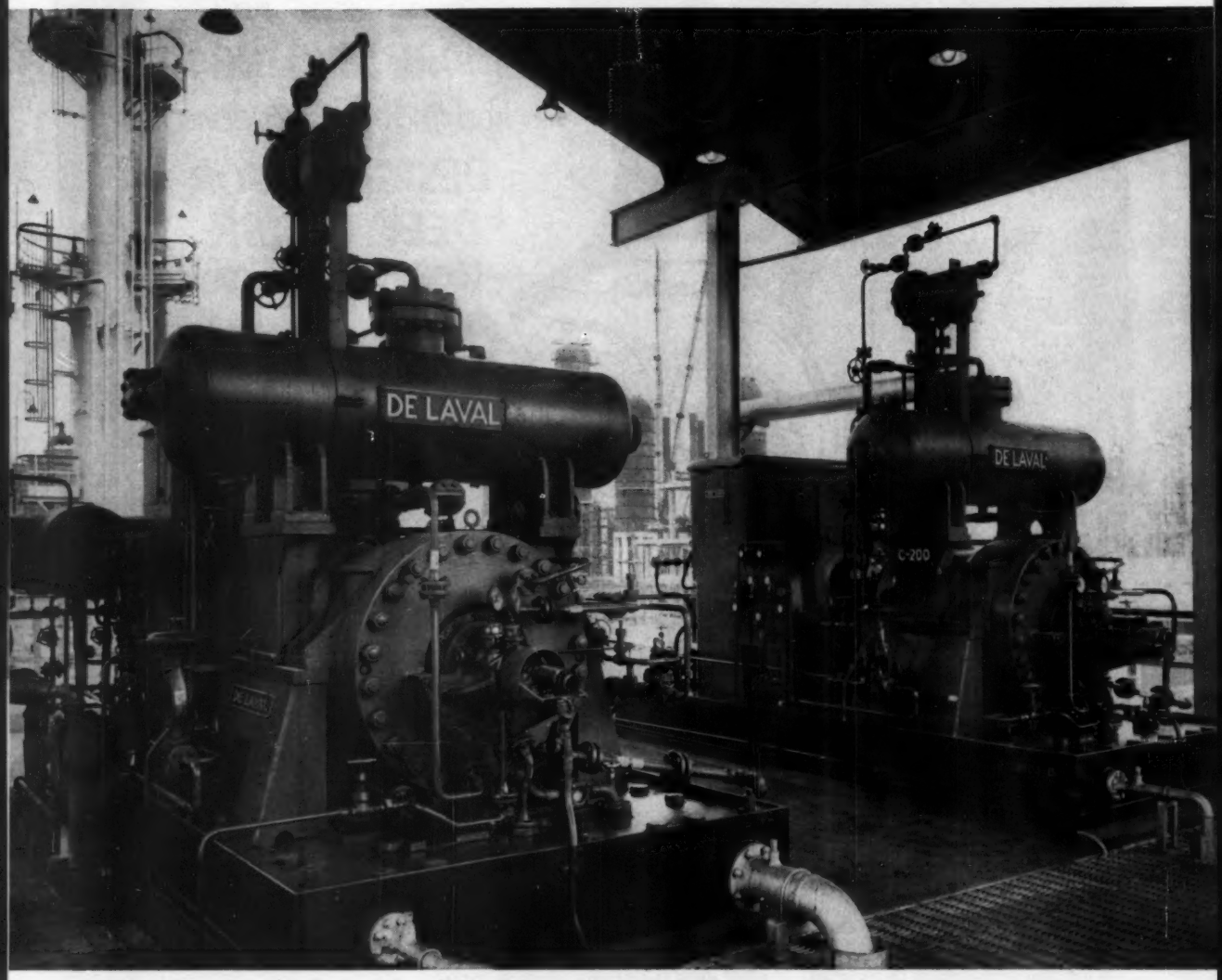


FIG. B





Creative Engineering by DE LAVAL



Designing to Customer's Requirements

De Laval makes all sizes and types of centrifugal compressors. But it's that little *extra,* which we call *creative engineering,* that makes De Laval so important to you. Take the two De Laval barrel type centrifugal compressors at Magnolia Petroleum's new refinery, Beaumont, Texas, for example. Designed around given job specifications, they give extra performance, longer life and trouble-free operation.

Whether it's centrifugal compressors, blast furnace blowers, ship propulsion units, turbine generators or other diversified products serving practically *all* industries, De Laval *creative engineering* plus precision manufacturing and highest quality control assures lasting customer satisfaction.

DE LAVAL *Steam Turbine Company*

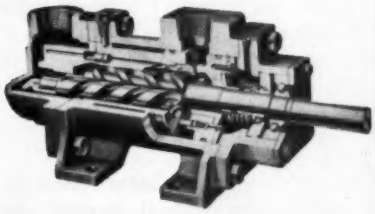
894 Nottingham Way, Trenton 2, New Jersey

L-429

More Ways

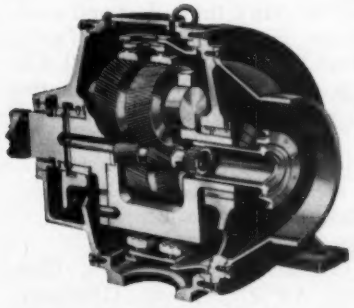
DE LAVAL

Creative Engineering Serves Industry



Versatile IMO Pump Does Many Oil-Handling Jobs

This unique De Laval IMO positive displacement pump is used widely for handling viscous fluids. Simplicity of design (only three moving parts) provides quiet pulsation-free high speed operation.



Hi-Speed, Hi-HP Planetary Gears

De Laval-Stoeckicht Planetary Gears deliver highest horsepower at high speeds in the most compact space. Light in weight, quiet running.

Many Advantages of Worm Gearing

De Laval worm gearing features interchangeability, high shock load capacity, long life, smooth quiet power, larger ratios, safety and ease of maintenance.

Send today for 48-page booklet—"Men, Machines and Materials at DE LAVAL."

De Laval Steam Turbine Company
894 Nottingham Way, Trenton 2, New Jersey

New Projects Reported

By Consulting Engineers

ALABAMA

Ammons, McClure & Caldwell
Atlanta, Georgia
¶ Air condition five U.S. post offices at Auburn, Opelika, Tuskegee, Phenix City, and Eufaula, Alabama. $143,000. Client, General Services Administration.

CALIFORNIA

A. M. Hegler
Santa Ana, California
¶ 360-bed acute diseases building, including administration section and kitchen facility for entire 1200-bed site. Six floors, 150,000 sq ft with five major surgeries and main dining room. (mech.) $4 million. Client, Orange County General Hospital.
¶ Laundry building for hospital, 12,000 sq ft. Also will handle laundry for adjoining juvenile hall and the county jail. (mech.) $175,000. Client, Orange County General Hospital.
¶ Mechanical design for new power plant for hospital building. (mech.) $150,000 (mechanical equipment only). Client, Orange County General Hospital.

Dudley Deane and Associates
San Francisco, California
¶ San Francisco International Airport improvements including new passenger terminal building, cargo terminal, and parking structure. (mech., elec.) $10 million. Client, City of San Francisco Public Utilities Commission.
¶ Kaiser Center, office building, garages, and shops, Oakland, Calif. (mech., elec.) $45 million. Client, Henry J. Kaiser.
¶ Bethlehem Pacific Steel office building, San Francisco. (mech., elec.) $12 million. Client, Bethlehem Pacific Steel Corporation.
¶ California Teachers Association state headquarters, Burlingame. (mech., elec.) $1.5 million. Client, California Teachers Association.

R. E. Layton & Associates
San Leandro, California
¶ Cannery storage facility, 80,000 sq ft, timber construction with glue laminated seams and girders. (civil, struc.) $250,000. Client, Hunt Foods, Inc., Hayward, Calif.
¶ Master plan for boat harbor. (civil, struc.) Client, City of San Leandro, Calif.
¶ Construction plans and specifications for boat-launching ramp and related facilities. $50,000 to $100,000. Client, City of San Leandro.

DELAWARE

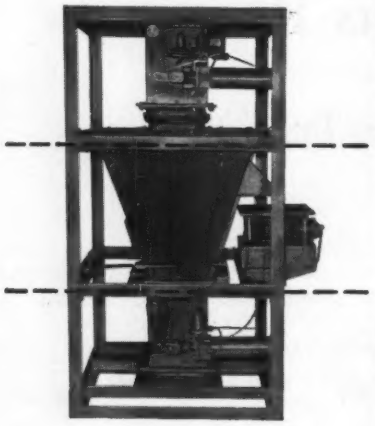
Clarke Gardner & Percy Sterling
Salisbury, Maryland
¶ Intercepting, lateral, and submain sewers, pumping stations, force mains, sewage treatment works, and outfall sewer, Lewes, Del. (civil) $800,000. Client, Board of Public Works, Lewes.

Daniel Koffler and Associates
New Castle, Delaware
¶ New structural steel and reinforced concrete floor system for existing printing plant paper warehouse, strengthening of existing piers, Wilmington, Del. (struc.) $5000. Client, Diamond Printing.
¶ Survey of fire damage to 4-story hotel of brick bearing wall and wood framing. Alteration work includes removal of two stories and reconstruction of hotel and night club. (struc., mech., elec.) Client, Grande Hotel.

FLORIDA

George L. Cadenhead
Fort Lauderdale, Florida
¶ Sewage treatment plant for Bethesda Memorial Hospital, Boyn-

THE W-C HOPPER SCALE



standardized components adapt it to a full range of material handling methods, control instrumentation

Take a good look at this hopper scale. It has many practical features for almost any weighing application.

Take the upper and lower frames. They are designed to accommodate many standardized feed and discharge components: sliding gates, vibratory feeders, screw feeders and others. These units are pre-engineered; their performance has been fully proven in use. Costs are, therefore, correspondingly lower. Satisfactory operation is confirmed in advance.

Now look at the middle or hopper frame. Note the flexure mountings. They give stability to the unit and deliver a single component of force to the weight transmitter regardless of load distribution. The transmitter, itself, may be either electric or pneumatic; the signal can be used for weight indication, recording, automatic batching.

Write for Catalog 12.
Clear text, lots of pictures.

W-C

S.A. 1659

WEIGHING and Control COMPONENTS, Inc.
206-F Lincoln Ave., Hatboro, Pa.

ton Beach, Fla. (struc., mech., elec.) $20,000. Client, Southeastern Palm Beach County Hospital Board.

¶ Addition to Florida High School, Pompano Beach, Fla. (mech., elec.) $1 million. Client, Broward County Board of Public Instruction, Courtney Stewart, Architect.

M. B. Garris
Miami, Florida

¶ Sanitary sewer system, pumping station and force main outfall. $700,000. Client, Town Bay Harbor Islands.

¶ Sanitary sewer system, Gables Estates, private. $300,000. Client, Three Bays Properties, Inc.

¶ Prestressed concrete bridge, paving and curb gutter, approaches. $150,000. Client, Town Bay Harbor Islands.

¶ Reclamation project including drainage canals and the necessary pumps. $150,000. Client, Hollywood Drainage District.

Briley, Wild & Associates
Daytona Beach, Florida

¶ Water treatment plant, storage tank and tower, distribution system and pump houses, and installation of pumps. (civil) $282,525. Client, City of Edgewater, Fla.

GEORGIA

Ammons, McClure & Caldwell
Atlanta, Georgia

¶ Decatur Memorial Hospital, Bainbridge, Ga. (mech.) $1,250,000. Client, Gregson & Associates.

IDAHO

Cornell, Howland, Hayes & Merryfield
Corvallis, Oregon

¶ Design Strategic Air Command alert facilities for Air Force Base, Idaho. (civil, struc., mech., elec.) $5 million. Client, Walla Walla District, USED.

LOUISIANA

George C. Hengy Company
Shreveport, Louisiana

¶ Commercial building. (civil, struc., mech., elec.) $75,000. Client, Bossier Rural Electric Corporation, Bossier City, La.

MARYLAND

Clarke Gardner & Percy Sterling
Salisbury, Maryland

¶ Intercepting sewers and sewage lift stations, Salisbury, Md. (civil) $475,000. Client, Salisbury Incinerator and Sewage Treatment Plant Commission, Salisbury, Md.

MICHIGAN

Ken Fishbeck
Lansing, Michigan

¶ Improvements to water system including iron removal, storage, and new well. (civil) $120,000. Client, City of Bronson, Mich.

MINNESOTA

E. F. Klingler & Associates
Eau Claire, Wisconsin

¶ Addition to Todd County Cooperative Dairy, drier plant and warehouse, Browerville, Minn. (arch., struc., mech., elec.) $200,000. Client, Todd County Cooperative Dairy, Browerville, Minn.

MONTANA

Flahart & Colgan
Rapid City, South Dakota

¶ Communication facilities, Glasgow Air Force Base, Glasgow, Mont. (elec.) $82,000. Client, Valley Rural Telephone Co-op, Glasgow, Montana.

NEW HAMPSHIRE

Henry J. Campbell, Jr.
Mineola, New York

¶ Moore classroom building, St. Paul's School, Concord, N.H. (elec.) $200,000. Client, Gugler & Kimball, Architects.

NEW MEXICO

J. L. Breese & Associates
Santa Fe, New Mexico

¶ Miscellaneous school facilities, Los Alamos, N.M. Joint venture with Bridgers & Paxton, consulting engineers. (mech.) Client, Flatow & Moore, Architect.

¶ Dormitory for El Rito Normal School, El Rito, N.M. (mech.) $75,000. Client, L. A. Garcia, Arch.

¶ County Health Center, Santa Fe,

WHEN DIRECT DRIVE VENTILATION EQUIPMENT IS DESIRED . . .

Specify Peerless-Electric® Non-Overloading Direct Drive Blowers

Tested and rated to AMCA specifications. All-welded wheels statically and dynamically balanced. Motor base, frame and housing completely welded together for added strength on larger sizes. 12½" to 36½" wheel diameters. 1,110 to 24,560 c.f.m.

No obstruction at inlet. Air enters blower wheel through smooth, spun venturi, passes quietly through wheel and discharges over airfoil cutoff. Peerless-built, self-limiting horsepower motor prevents overloading at any condition.

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Designed for efficient, continuous, quiet duty in air conditioning systems in schools, labs, public buildings, industrial and commercial installations.

Simplicity of construction and sound engineering assure years of highly efficient, low noise level operation. 12½" to 36½" wheel diameters . . . 686 to 26,044 c.f.m.

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A COMPLETE LINE OF AIR MOVING EQUIPMENT

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but not the light

Hendrick Mitco takes the brunt of heavy, continuous industrial or pedestrian traffic without bending or warping. Yet, its 90% open area lets in plenty of light and air. Mitco is pressure-formed to give it this high strength—and as a result, extremely long life. For more information, write direct to your local sales office.

Hendrick Mitco . . . *the grating with the Deep Cross Bar*

Hendrick
MANUFACTURING COMPANY
42 DUNDAFF STREET, CARBONDALE, PA.
Sales Offices in Principal Cities

N.M., heating and plumbing. (mech.) $160,000. Client, Clark & Register, Architect.
¶ REA office building, Taos, N.M., heating and plumbing. (mech.) $65,000. Client, L. A. Garcia, Arch.

NEW YORK

Joseph A. Kestner, Jr.
Troy, New York
¶ Intercepting sewers, sewage pumping, and primary sewage treatment facilities. (civil) $700,000. Client, Village of Tupper Lake.
¶ Electrical control system for water supply pumping. (elec.) $20,000. Client, Hoosick Falls.

Henry J. Campbell, Jr.
Mineola, New York
¶ Cure of Ars Church, Merrick, N.Y., alterations and modernization. (mech., elec.) $150,000. Client, A. F. Meissner, Architect.
¶ Oppenheim Collins store, Roosevelt Field, N.Y. (mech., elec.) $150,000. Client, J. H. Barry, Arch.

Melvin H. Friedman & Associates
Bergenfield, New Jersey
¶ Addition to steam controls to existing system; motorization of trash gate at Poppolopen Creek; addition of electronic safety controls to existing boilers for U.S. Military Academy, West Point. (mech., elec.) $36,000. Client, Schofield & Colgan, Architects, and USMA.

Slocum & Fuller
New York, New York
¶ Meditation Center, Colgate University. (mech., elec.) $500,000. Client, Skidmore, Owings & Merrill, Architect-Engineers.

NORTH CAROLINA

Walter G. Smith
Durham, North Carolina
¶ Dormitory, North Carolina College, Durham, N.C. (mech., elec.) $150,000. Client, R. R. Markley, Architect.

Campbell & Leppard
Greenville, South Carolina
¶ Grove arcade — addition of air conditioning, Asheville, N.C. (plumb., mech., elec.) $36,000. Client, G.S.A., Atlanta, Ga.

NORTH DAKOTA

Flahart & Colgan
Rapid City, South Dakota
¶ 1184 miles rural telephone lines and two unattended dial exchanges. (elec.) $947,200. Client, Souris River Mutual Aid Telephone Corporation, Minot, N.D.
¶ Communication facilities, Minot Air Force Base, Minot, N.D. (elec.) $140,000. Client, Souris River Mutual Aid Telephone Corporation, Minot, N.D.

OHIO

Russell S. Fling
Columbus, Ohio
¶ Animal science building, Ohio State University, Columbus, Ohio. (struc.) $1.1 million. Client, Ramsey, Croce & Abbot, Architects.
¶ Linden-McKinley junior-senior high school memorial stadium, Columbus, Ohio. (struc.) $150,000. Client, Board of Education, Columbus, Ohio.

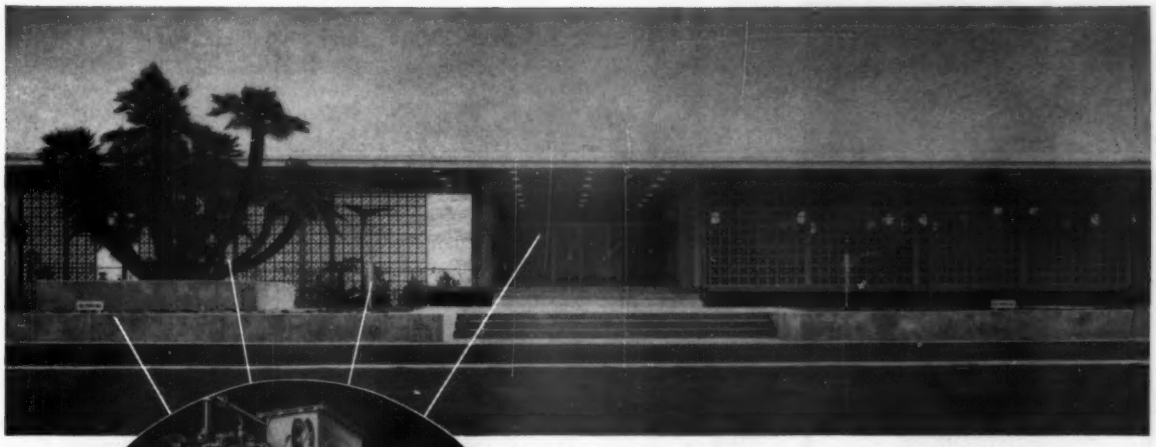
Consoer, Townsend & Associates
Chicago, Illinois
¶ Storm sewers, Hamilton, Ohio. (civil) $100,000. Client, City of Hamilton, Ohio.

William Schuller
Toledo, Ohio
¶ New Hiawatha School, including 15 rooms and gymnasium, Washington Township, Lucas County, Ohio. (struc.) $520,000. Client, Hahn & Hayes, Architects.
¶ St. Stephen's School addition, 12 rooms and gym, Toledo, Ohio. (struc.) $246,000. Client, C. Thomas Schauder, Arch.

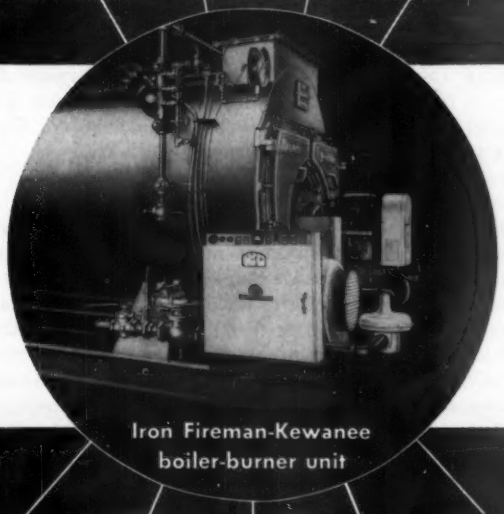
OKLAHOMA

Craig & Keithline
Tulsa, Oklahoma
¶ Functional and right-of-way plans for one-fifth of Tulsa metropolitan area expressway system. (civil) $110 million. Client, Oklahoma Highway Department.

E. H. Schmidt and Associates, Inc.
Tulsa, Oklahoma
¶ Surveys and design of 14.5 miles of interstate U.S. highway 3 between Fort Smith, Ark. and Salli-



Screened facade of Stuart Co. plant, Pasadena, California



Iron Fireman-Kewanee boiler-burner unit

Where the *steam* comes from...

for both heating and pharmaceutical processing

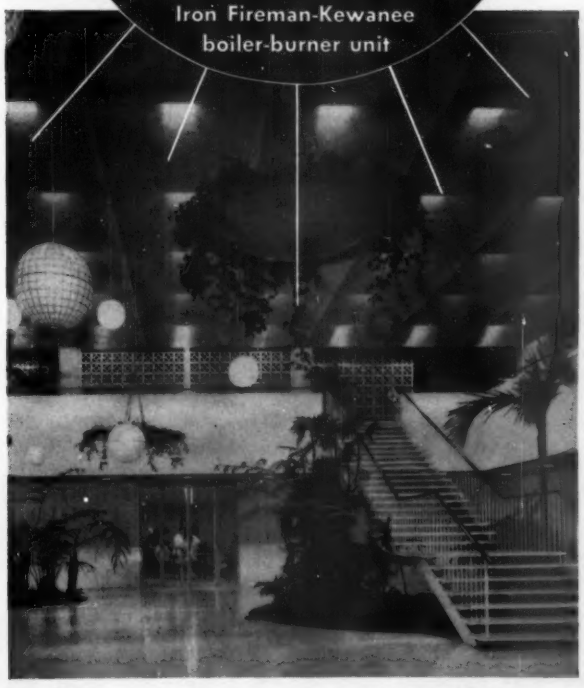
One of the notable commercial buildings of the year combines maximum utility with such striking beauty that it has won nation-wide acclaim. Designed by Edward D. Stone, this plant is used by the Stuart Co. for the production of pharmaceuticals.

Up-to-the-minute mechanical equipment includes two Iron Fireman-Kewanee boiler-burner units. Due to forced draft firing, there is no stack to mar the symmetry of the building. Dual-fuel burners efficiently fire gas or any grade of light or heavy oil, with quick changeover.

Complete Iron Fireman boiler-burner units can be easily sized, specified and ordered from a single catalog, with a single model number.

Conservative rating permits an easy, economical "cruising speed" at rated output, with 50% reserve capacity and consequent minimum noise level and low maintenance costs.

Mail coupon for detailed information and specifications.



Lounge and offices overlook spacious atrium

Architect: Edward D. Stone

Mechanical Engineers: Stockly & Bamford

Mechanical Contractors: Hickman Bros., Inc.

IRON FIREMAN®

AUTOMATIC FIRING EQUIPMENT FOR HEATING, PROCESSING, POWER

IRON FIREMAN MANUFACTURING CO.
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Please send catalog and specifications on following equipment:

- ☐ Complete boiler-burner units
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mc Philben's 45 line edge-lit directionals are designed to blend with the finest contemporary decor in hotel lobbies, auditoriums, office buildings, schools and other public locations.

Gleaming satin finish . . . solid cast aluminum construction . . . wall, ceiling or surface mountings . . . incandescent and fluorescent models . . . invisibly hinged access doors . . . flush fasteners . . . acrylic Plexiglass inscription panels illuminating full length of letter . . . these are some of the features making mc Philben's 45 line edge-lit directionals the architect's first choice for use in the nation's finest buildings.

The 45 line series is available with either "exit" or special wording inscriptions. 4½", 6" or 8" lettering with red, green and white color combinations conform with all local regulations.

Contact your mc Philben representative today for full details. See our insert in Sweet's file 1f or write for data sheet E/1.

mc Philben
LIGHTING COMPANY
1329 Willoughby Avenue
Brooklyn 37, New York

saw, Okla. $6.5 million. Client, Oklahoma Highway Department.

OREGON

Cornell, Howland, Hayes & Merryfield
Corvallis, Oregon
¶ Design mechanical and electrical facilities for shop building, Salem, Ore. (mech., elec.) $190,000. Client, Marion County (Ore.) Court.
¶ Preliminary plans and cost estimates for streets and utilities in the relocated town of Arlington, Ore. Present site will be flooded by John Day Dam. (civil, struc., elec.) Client, Walla Walla District USED.
¶ Design tilt-up concrete building with glued-laminated roof structure, forced-air heating system, to be used for warehouse and wholesale sales area, Corvallis, Ore. (civil, struc., mech., elec.) $45,000. Client, Roeser's Supply.
¶ Mechanical and electrical design of facilities for Salem Presbyterian Church, Salem, Ore. Church will be cut in half lengthwise and expanded to provide greater floor space; new educational wing also is to be added. (struc., mech., elec.) $800,000. Client, James L. Payne, Architect.

N. W. Haner & Associates
Portland, Oregon
¶ Interceptor sewer system, storm relief sewers, and sewage treatment plant. (civil) $580,000. Client, City of St. Helens, Ore.
¶ Interceptor sewers, pumping stations, and sewage treatment plant. (civil) $310,000. Client, City of Clatskanie, Ore.

PENNSYLVANIA

Damon & Foster
Sharon Hill, Pennsylvania
¶ Comprehensive sewer plans including pumping station and force main. (civil) $1.5 million. Client, The Upper Chichester Municipal Authority.

Robert C. Burns Associates
Philadelphia, Pennsylvania
¶ Philadelphia International Airport, runway lighting for extension of instrument runway for jet aircraft operation. 10,000 feet of new high intensity runway lighting, taxiway lighting, and extension of power facilities. (elec.) Client, Division of Aviation, City of Philadelphia, Pa.

Chester Valley Engineers
Paoli, Pennsylvania
¶ Storm water drainage. (civil) $15,000. Client, Kennett Square Borough.
¶ Fire house alteration. (struc.) $25,000. Client, West Bradford Township.
¶ Storm water drainage, Nike sites, Philadelphia area. (civil) $40,000. Client, U.S. Corps of Engineers.
¶ Paving of shopping center, Quakertown, Pa. (civil) $6000. Client, Quakertown Markets.

H. G. Metzger Jr. & Associates
Huntingdon Valley, Pennsylvania
¶ New convent for Saint Joseph The Worker Roman Catholic parish, Fallsington, Pa. (mech., elec.) $150,000. Client, Richard E. Vogel, Architect.
¶ Tullytown fire house alterations and additions, Tullytown, Pa. (mech., elec.) $50,000. Client, Richard E. Vogel, Architect.
¶ Church and Sunday school building, St. John's Evangelical Lutheran Church, Fullerton, Pa. (mech.) $350,000. Client, Charles M. Talley, Architect.
¶ Church and Sunday school additions, First Methodist Church, Lima, Pa. (mech.) $180,000. Client, Charles M. Talley, Arch.
¶ Penn-Packing Co., Philadelphia, Pa. Survey of mechanical facilities, steam and hot water. (mech.) Client, Penn-Packing Co.

Slocum & Fuller
New York, New York
¶ Pomeroy's Department Store, Harrisburg, Pa. (struc., mech., elec.) $1.2 million. Client, Pomeroy's, Inc., Harrisburg.

SOUTH CAROLINA

Campbell & Leppard
Greenville, South Carolina
¶ Boulevard Baptist Church, Anderson, S.C. (elec.) $10,000. Client, Ledbetter & Earle, Arch.
¶ Greenville County Nursing Home, Greenville, S.C. (plumb.,

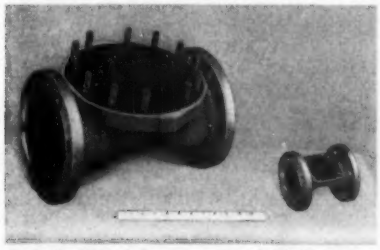
Now Penton's* Miracle Characteristics are put to use in Diaphragm Valves!

Hills-McCanna's Exclusive New Lining Meets Many of the Service Requirements That Once Called For Stainless Steel and Glass!

By: R. McFarland,
Technical Director,
Hills-McCanna Company

Here at Hills-McCanna an exhaustive search has paid off: a new lining material for diaphragm valves matches the economies of rubber lining while meeting many of the service requirements of glass lining and stainless steel.

A new Penton plastic-lined valve body (pictured below) has been developed, tested and readied for the specialized needs of the processing industries.



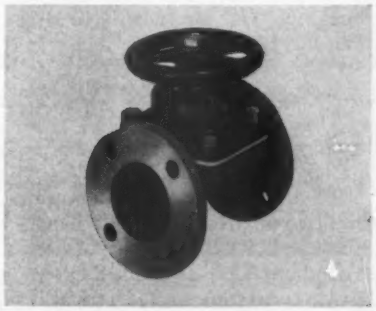
A six inch and three quarter inch Penton lined valve body

Because of its wide versatility, we believe a brief rundown on the new product's unusual characteristics and its ability to cope with diverse chemical service applications will be of interest to you.

Economically, the Penton plastic-lined valve stands alone. Competitively priced with rubber-lined valves, it meets every requirement placed on the hard rubber-lined types. This versatile valve has the ability to meet many of the service requirements that once called for the higher-priced stainless steel and glass-lined valves.

Performance-wise, Penton (a chlorinated polyether polymer), a product of Hercules Powder Company, affords an excellent combination of temperature resistance, chemical resistance and exceptional dimensional stability. *Penton is durable:* it takes up to 300°F without losing its ability to withstand corrosion. Also, it is absolutely non-contaminating; cannot affect a product's taste, aroma or color.

The design features of the Hills-McCanna valve body make it possible to take advantage of the excellent properties of the Penton lining. Chemically resistant Penton lining, in an armored body of cast iron or aluminum, offers the most universally adaptable processing valve available today. It handles *more* substances . . . and works equally well with metallic, plastic, glass and lined piping.

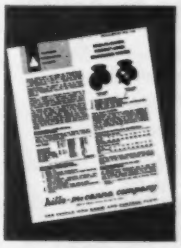


Above is a complete handwheel operated Diaphragm Valve with Penton lined body

Penton lined diaphragm valves are available in sizes ½" thru 6" with flanged ends, and diaphragm valves with solid Penton bodies are available in sizes ½" thru 2" with screwed ends.

As with all Hills-McCanna diaphragm valves, the valve is of packless construction. Its working parts are isolated from flow, and are easily accessible for simple in-line maintenance.

To introduce this valve—and to give you the opportunity of noting the properties of Penton—we have prepared a concise Technical Information Bulletin, No. 114. It contains more than 250 of the more common chemical services, temperature and pressure specifications, and elaborates on the typical services in which Penton lined valves can be used.



Supplementing the booklet is the Penton "Dollar." An immersion disc of solid Penton, it can be used to demonstrate its unusual chemical and temperature resistance characteristics. Let the Penton "Dollar" show you how you can save dollars with the use of Hills-McCanna Penton lined valves in your plant. Both Bulletin and "Dollar" are available via letterhead request. Write: *Hills-McCanna Company, 4575 W. Touhy Avenue, Chicago 46, Illinois.*

*Penton is a registered trade name of Hercules Powder Company

X MARKS THE CRITICAL SPOTS!

It takes more than muscles to build a storage bin

Before the physical work of building a bin begins, we must know the problems involved at the *Three Critical Points.*

- X What is the loading problem?
- X What are the characteristics of the material to be stored . . . and its "flowability"?
- X What is the volume and rate of discharge?

When planning your next storage bin, may we sit in on the very early stages of planning?

NEFF & FRY COMPANY
302 Elm St., Camden, Ohio

N & F

You can always spot a Neff & Fry Bin by the shape of the stave!

mech., elec.) $78,521. Client, Leon LeGrand, Arch.

¶ Holiday Inn Motel, Greenville, S.C. (plumb., mech., elec.) $138,000. Client, R. H. Longstreet & Associates, Architects.

¶ Byerly Hospital, Hartsville, S.C. (plumb., mech., elec.) $75,000 (est.). Client, Baker & Gill, Arch.

¶ Renovation, Riggs Hall, Clemson, S.C. (mech.) $140,000. Client, Clemson College.

¶ Plant air conditioning system, Seneca, S.C. (mech.) $140,000. Client, J. P. Stevens & Co., Inc.

¶ Florence County Health Clinic, Florence, S.C. (plumb., mech., elec.) $79,512. Client, Baker & Gill, Architects.

J. C. Harrison
Spartanburg, South Carolina

¶ Apartment building, air conditioning and heating. (mech.) $2 million. Client, D. W. Cecil.

¶ City jail, Spartanburg, S.C., plumbing and heating. (mech.) $400,000. Client, D. W. Cecil.

¶ Inman Baptist Church, Inman, S.C., plumbing and heating. (mech.) $150,000. Client, W. M. Hudson.

¶ Drayton Baptist Church, Drayton, S.C., plumbing and heating. (mech.) $200,000. Client, A. H. Chapman.

¶ Spartanburg Municipal Airport, air conditioning. (mech.) $20,000. Client, City of Spartanburg, S.C.

¶ Mayfair Mills, Spartanburg, S.C., air conditioning. (mech.) $50,000. Client, Mayfair Mills.

¶ Schuyler office building, Spartanburg, S. C., air conditioning. (mech.) $20,000. Client, Cecil's, Inc.

SOUTH DAKOTA

Flahart & Colgan
Rapid City, South Dakota

¶ 300 miles of rural telephone lines and two unattended dial exchanges. (elec.) $240,000. Client, Midstate Telephone Co., Kimball, S.D.

¶ One substation and electrical distribution facilities. (elec.) $90,000. Client, Butte Electric Co-op, Newell, S.D.

¶ Two substations and electrical distribution facilities. (elec.) $220,000. Client, West River Electric Co-op, Wall, S.D.

TENNESSEE

Hazzard, McRoy & Cone
Birmingham, Alabama

¶ Carter County Hospital, Elizabeth, Tenn. (mech., elec.) $1.5 million. Client, C. H. McCauley, Arch.

TEXAS

Freese, Nichols & Turner
Houston, Texas

¶ Water and sewer system improvements including: 11.5-mgd water pump station, 4-mgd sewage treatment plant, ground and elevated water storage tanks, sewage lift stations, water and sewer lines, and 3.5-mgd water well. (civil, struc., mech., elec.) $1,750,000. Client, City of Orange, Texas.

¶ Water system extension. (civil) $100,000. Client, City of Port Arthur, Texas.

¶ Drainage improvements including: storm sewers, drainage pumping stations enlargements. (civil, struc., mech., elec.) $450,000. Client, City of Port Arthur, Texas.

¶ Drainage improvements. (civil, struc.) $100,000. Client, City of Port Arthur, Texas.

¶ Water and sewer system improvements including elevated water storage tank, water and sewer line, and extensions. (civil, struc., mech.) $250,000. Client, City of Groves, Texas.

¶ Sewer system improvements including 9-mgd sewage treatment plant, sewage lift stations, and outfall sewer lines. (civil, struc., mech., elec.) $3 million. Client, Metropolitan Sanitary Sewage District of South Jefferson County.

Forrest and Cotton, Inc.
Dallas, Texas

¶ Texas Air National Guard facilities, Dallas. (civil, struc., mech., elec.) $2 million. Client, U.S. Navy.

¶ Preliminary report covering storm drainage—criteria and master plan for Waco Creek. Client, City of Waco, Texas.

VIRGINIA

J. A. Gustin & Associates
Martinsville, Virginia

¶ Design and layout of water system, golf course, and streets, Mar-

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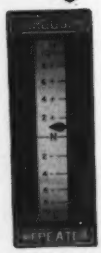
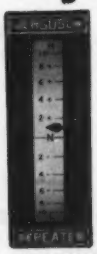


Repeater



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tinsville, Va. (civil) $300,000. Client, The Chatmoss Corporation.
¶ Design street system and drainage, water works, recreational area, Ridgeway, Va. (civil) $150,000. Client, Cloverleaf Terrace, Inc.
¶ Design and location survey, Doyle Street bypass, Martinsville, Va. (civil) Client, Department of Public Works, City of Martinsville, Va.

WASHINGTON

N. W. Haner & Associates
Portland, Oregon
¶ Initial development of 200-acre Burbank site of Port Walla Walla on Columbia River at mouth of Snake River. Includes transit grain facility providing 650,000 bu of storage and facilities for grain handling by truck, rail, and barge. Railroad and road accesses, grading and site development, and construction of barge-mooring facilities are included. Supplementary development includes 10-acre site grading and rail access for steel fabrication plant. (civil) $650,000. Client, Port of Walla Walla, Wash.
¶ Port of Ilwaco boat basin for commercial and sport fishing including mooring floats, dolphins, and commercial building site development. (civil) $260,000. Client, Port of Ilwaco, Wash.

WISCONSIN

Consoer, Townsend & Associates
Chicago, Illinois
¶ Central Expressway, Milwaukee, Wis. (struc.) $7 million. Client, Milwaukee County Expressway Commission.

R. J. Abramson & J. M. Klipp
Chicago, Illinois
¶ Nike installation, Milwaukee, Wis. (elec.) Client, U.S. Corps of Engineers.

Alvord, Burdick & Howson
Chicago, Illinois
¶ Sewage disposal and intercepting sewers. (civil) $50 million. Client, City of Milwaukee and Metropolitan Sewerage Commission.

E. F. Klingler & Associates
Eau Claire, Wisconsin
¶ New power plant. (arch., struc., mech., elec.) $300,000. Client, Turtle Lake Co-op Creamery Association, Turtle Lake, Wis.
¶ New drier plant and warehouse. (arch., struc., mech., elec.) $300,000, Client, Turtle Lake Co-op Creamery Association, Turtle Lake.
¶ New elementary school. (arch., struc., mech., elec.) $320,000. Client, Sacred Heart Parish, Eau Claire, Wis.

J. D. Hurley Engineering Service
Brookfield, Wisconsin
¶ Layout and platting of subdivision. (civil) $16,000. Client, Robert H. Baas.

A. Epstein and Sons, Inc.
Chicago, Illinois
¶ Grocery warehouse, Wauwatosa, Wis. (civil, struc., mech., elec.) $1 million. Client, Kohl's Food Stores.

FOREIGN

J. A. Gustin & Associates
Martinsville, Virginia
¶ Preliminary design, chemical lime plant, Venezuela, S.A. (struc., mech., elec.) $350,000. Client, Alexander Bernard & Co.

Lev Zetlin
New York, New York
¶ Nuclear research reactor — pool shielding, Middle East. (struc.) $1.5 million. Client, Government. Philip Johnson, Arch.
¶ U.S. Ambassador's residence, New Delhi, India. (struc.) $400,000. Client, State Department, Edward D. Stone, Arch.

Titlestad Corporation
New York, New York
¶ 275 metric tons/day pyrites-burning contact-type sulfuric acid plant for Kaohsiung, Taiwan. (chem., struc., mech., elec.) $2 million. Client, Kaohsiung Ammonium Sulfate Corp. (through U.S. International Cooperative Adminstration).

Henry J. Campbell, Jr., P.E.
Mineola, New York
¶ Pool and bathhouse, South Korea. Gymnasium, swimming pool, lockers, showers, exercise room, and handball courts. (mech., elec.) $900,000. Client, Engineers, Raymond & Rado. ▲▲

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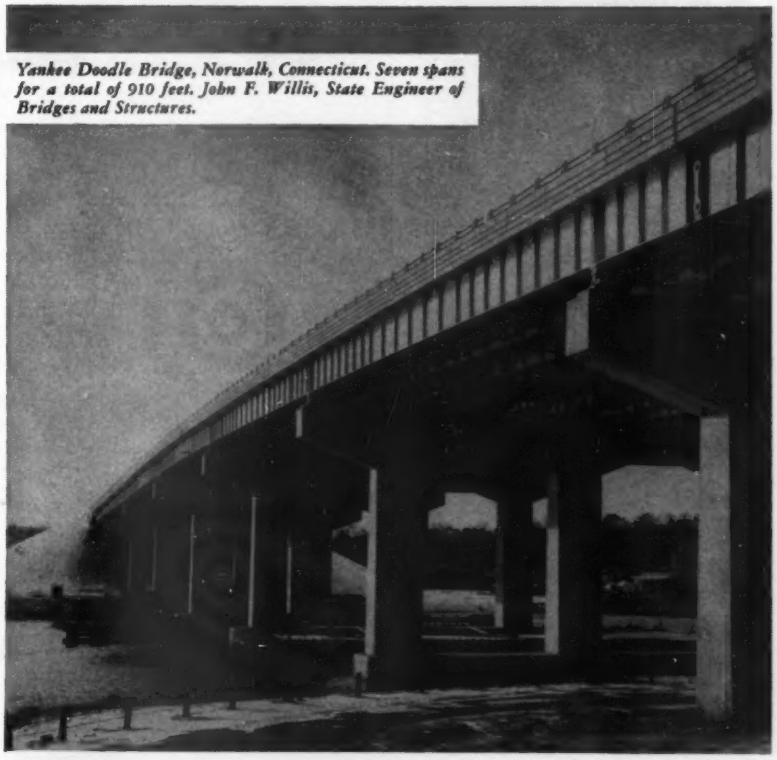

Yankee Doodle Bridge, Norwalk, Connecticut. Seven spans for a total of 910 feet. John F. Willis, State Engineer of Bridges and Structures.

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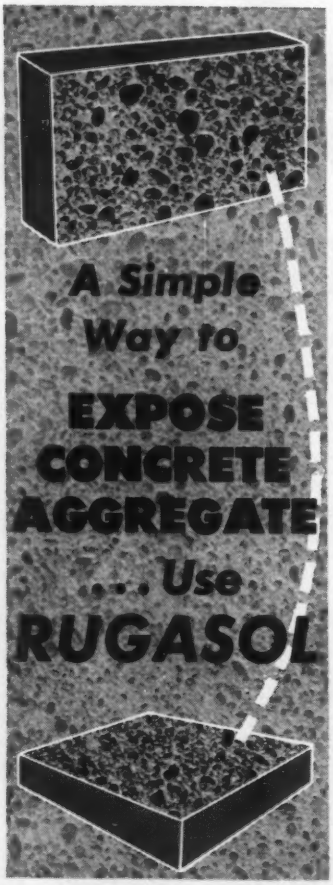

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Books

For the Libraries of Consulting Engineers

DESIGN OF CONCRETE STRUCTURES, Sixth Edition, by Leonard C. Urquhart, Charles E. O'Rourke, and George Winter; McGraw-Hill Book Co., Inc., New York; 537 pp.; $8.00.

Reviewed
by
Edward H. Harris
Consulting Engineer
New Orleans, La.

The sixth edition of this standard text and reference has been revised to reflect changes introduced in the 1956 revisions of the ACI Building Code. In this edition ultimate strength design emerges as an accepted alternate procedure.

The various structural concrete components for buildings and bridges are covered, and an unusually well planned integration of the components into the completed structure is presented. The figures are well prepared and are appealing to the practicing engineer. Many good construction details are given, and while the practicing engineer probably will have other tables and diagrams he will continue to use, these sections are complete. The material on prestressed concrete is brief, but it is a good introduction to the principles. Definitive references are listed throughout.

Ultimate strength design is covered somewhat more completely and gives enough philosophy and background to carry the reader through designs from loads to member sizing.

The sample Design Computation sheets are good models of orderly work, and several sample structural plan sheets of equal value are included.

Of particular value are the sections on continuous beams, arches, and rigid frames, in which continuity is discussed and several classic and modern methods of analysis are presented.

This text merits a place in the working libraries of those practicing in this field. It would be difficult to improve on the presentation, and the quality of previous editions is rigidly upheld.

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The 1958 edition of the American Road Builders Association directory of "Highway Officials and Engineers" is now available. This 120-page pocket-size booklet contains more than 1700 names, titles, and addresses of administrative engineers and officials in the 48 state highway departments, the District of Columbia, and the departments in Hawaii and Puerto Rico.

Included are administrative personnel of the Bureau of Public Roads, with the heads of its regional offices and the division offices in each state. Engineers and administrative personnel of the na-

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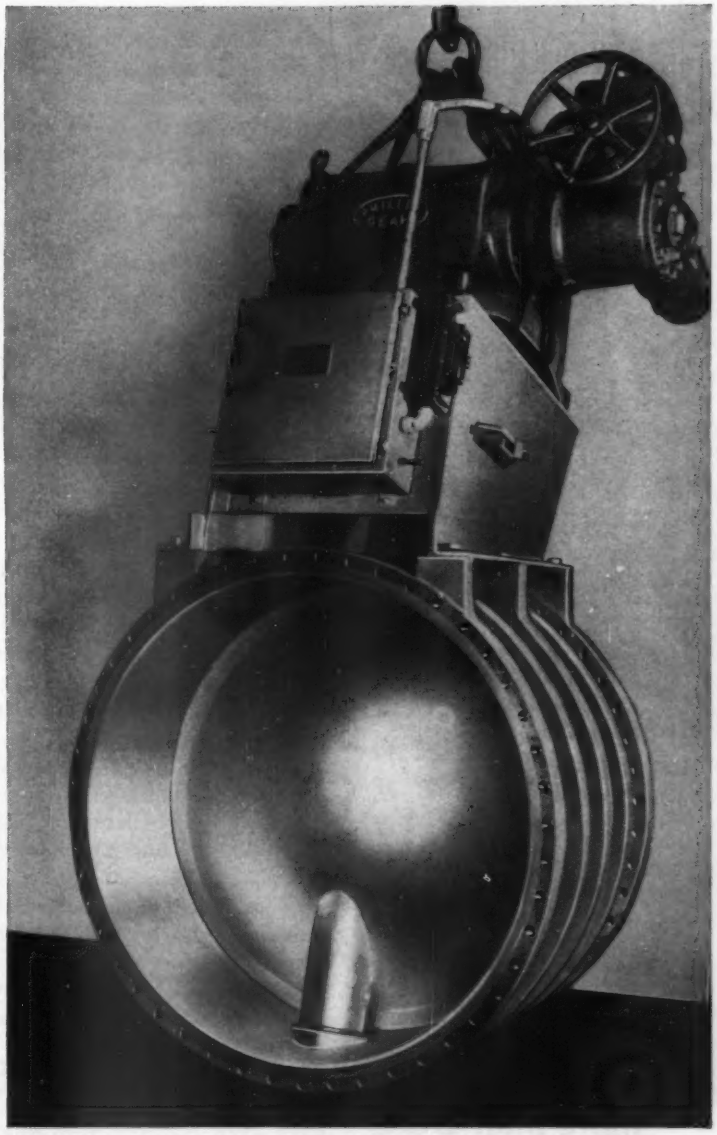

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tion's toll road authorities also are listed in the booklet.

Directory is available at $1.00 per copy from the American Road Builders Association, World Center Building, Washington 6, D.C.

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AUTOMATIC CONTROL: PRINCIPLES AND PRACTICE, by Werner G. Holzbock; Reinhold Publishing Corp., N.Y.; 282 pp.; $7.50.

Reviewed
by
L. A. King
Jackson & Moreland, Inc.

This book has been prepared for readers with an interest in the functioning and application of automatic control components and systems used in process control. The reader is presumed to have little background in mathematics and the physical sciences and little prior knowledge of control components or systems.

The book is divided into three main sections. Chapters 1 through 5 describe the effect of various static and dynamic characteristics on the performance of control systems. Much of this material is presented clearly and concisely. Although the static and dynamic characteristics are described physically rather than mathematically, certain algebraic formulas are included. Chapters 6 through 11 contain a detailed discussion of the various components of process control systems. Chapters 12 and 13 discuss typical control systems and their applications.

The first section of the book suffers from statements that can be misinterpreted. For example, of greatest importance to the practicing control engineer is a thorough understanding of time lags. The author's discussion of the simple first-order time lag is somewhat misleading. The discussion of the subject gives the impression that either resistance or capacitance will produce a time lag. Actually, time lag results from a combination of resistance and capacitance. This fact could be brought out clearly if a little elementary mathematics had been included.

Automatic Control: Principles and Practice must be regarded as a book for beginners. The strongest points in favor of the book are that it makes the reader aware of some of the basic problems and characteristics of control systems and control components, the subject matter is logically arranged, and the author presents a great deal of information. However, there is not sufficient information presented to permit solution of many practical control problems.

•

ESTIMATING CONSTRUCTION COSTS, Second Edition, by R. L. Peurifoy; McGraw-Hill Book Co.; 446 pp.; $10.75.

This new edition is designed to give the reader a full understanding of the principles of estimating construction costs. It includes accurate production rates for labor and equipment, and covers the costs of many types of construction equipment, including the hourly costs of owning and operating such equipment.

Costs of materials, equipment, and labor for a wide variety of projects — foundations, highways, concrete, floor systems, steel structures, utility systems — are covered. Indirect costs such as insurance, taxes, bonds, supervision, overhead, and profit also are included.

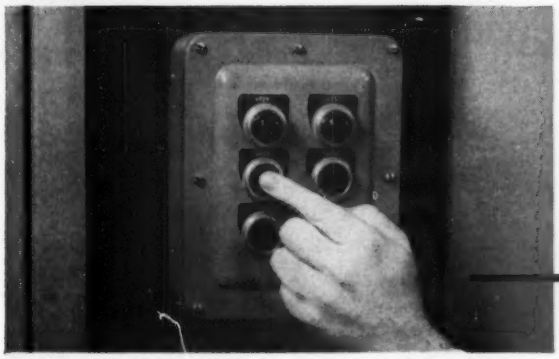
•

ADHESIVES AND SEALANTS IN BUILDING, NAS Publication No. 577, published by the Building Research Institute; 160 pp.; $5.00.

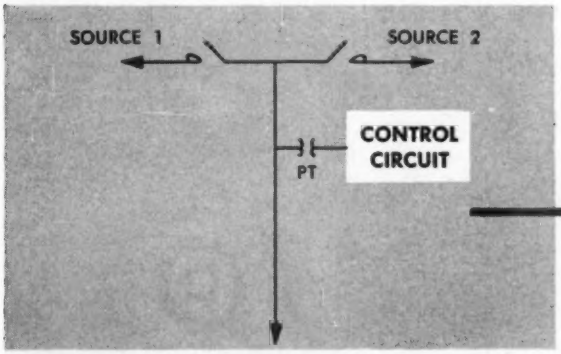
Up-to-date applications of adhesives and sealants in building construction and the trends for the future are presented in this volume, which contains reports of 22 of the nation's experts on the subject.

Individual sections of the book discuss sealing joints in the building exterior (as applied to both

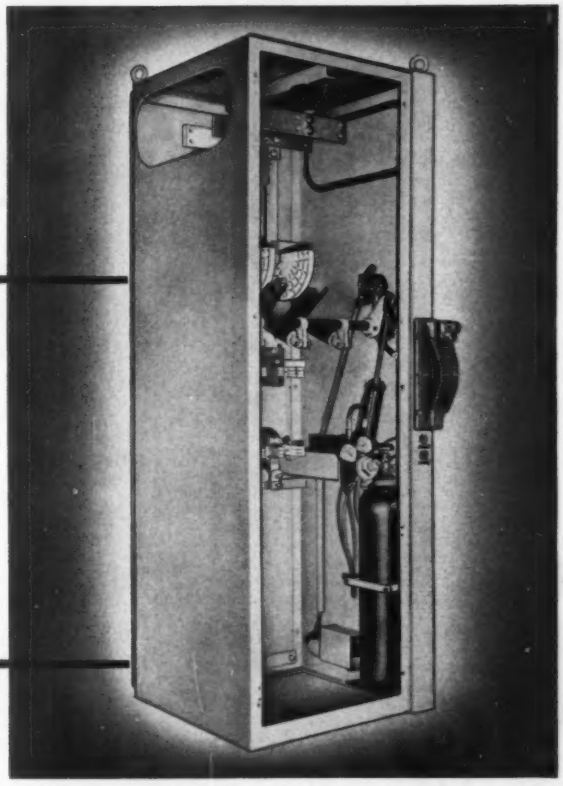
R&IE ELECTRO-PNEUMATIC OPERATOR



Remote-control pushbuttons for switches scattered throughout a plant, or in a number of plants, may be grouped on a single control panel.



Automatic control requires only the addition of relatively simple control circuitry. In the application shown above, the loss of preferred voltage provides the necessary signal for automatic throwover to the emergency source. Only one PT is required in the load circuit.



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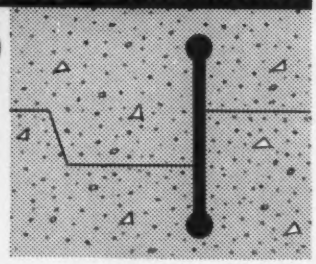

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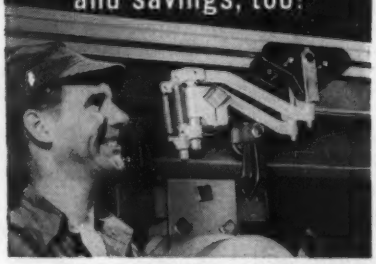

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traditional materials and metal curtain walls); adhesives for the building interior; adhesives for structural materials and components; and the future of adhesives and sealants in building.

Among the reports is one on new developments with adhesive tapes for building panels. Test results are described on buildings using single coated tapes as seals, and panels joined by doubly coated and high strength bonding tapes which can eliminate such point connectors as screws and bolts and distribute the stress evenly over the bonded surface of the building.

Advances also are presented in the use of bonding agents for cementitious materials, such as the bonding of cement plaster to smooth tilt-up walls, and new concrete to old.

This book may be ordered from the Publications Office, National Academy of Sciences, 2101 Constitution Ave., Washington 25, D.C.

•

LOGICAL DESIGN OF DIGITAL COMPUTERS, by M. Phister; John Wiley & Sons, Inc.; 408 pp.; $10.50.

Reviewed
by
Charles E. Stewart
Research Engineer
Armour Research Foundation

The intent of the author is to provide a textbook for a course in computer logic, and also "to present the practical application of these [digital computer design] techniques to interested engineers, mathematicians, and physicists." The author has fulfilled his purpose admirably.

However, as is pointed out in the preface, there are certain facets of computer design that are omitted or to which detailed consideration has not been given. The book essentially is restricted to the design of serial computers and/or computers employing synchronous circuit components. An excellent argument is presented justifying these restrictions, in addition to the usual one of space limitations: "The computer systems are so intricate that it is often difficult to derive computer circuits *without* (the italics are the author's) using Boolean algebra; and although much work is being done on the synthesis and analysis of synchronous computer circuits, such circuits have inherent timing problems which tend to make their interconnections difficult and which thus obscure their intended functions."

Boolean algebra, an important tool for logical designers, is presented in Chapter 3 in axiomatic fashion with numerous examples illustrating many of the theorems proved there. Since the treatment is intended only as an introduction to Boolean algebra, "many of the fine points essential to mathematical rigor" have been ignored.

The book includes many worked examples and exercises, and is suitable for self-study for a serious student. A particular instance of the seriousness of effort required is to be found in one of the basic chapters of the book, Chapter 4, which requires very careful reading. In this chapter a complete discussion of the simplification processes for Boolean functions is given. The reader is led from the most cumbersome method (the Quine method) through two extensions and modifications of it (the Nelson method and the Harvard method) to an easier and considerably simpler process called the Veitch diagram simplification method. This last process is used extensively throughout the remainder of the book.

In Chapter 6 certain methods of design which have been used in synthesizing computers are described. The general model for a digital system constructed by Huffman and Moore is described and a circuit analysis using the Huffman-Moore model is presented. Also, the Huffman-Mealy method of circuit simplification is introduced and applied in this chapter. Further use of the Huffman-Moore

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model is made in Chapter 9 in the discussion of the rules that may be employed in mechanizing the various arithmetic operations.

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The value of the book is enhanced by the inclusion of many references which give the serious student an opportunity to pursue many of the briefly covered ideas of the book.

•

CITY PLANNING: A BASIC BIBLIOGRAPHY, a 100-page committee report of the California Council of Civil Engineers and Land Surveyors has been reissued and made available for free distribution. The book is being used as a training manual by International Housing Service and the City of Detroit. Copies are available from the Council, 1107 Ninth St., Sacramento 14, Calif.

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A complete English translation of the leading Russian monthly journal devoted to automatic control, *Avtomatika I Telemekhanika*, is now available at low-cost subscription rates. This new service has been undertaken jointly by Massachusetts Institute of Technology, the National Science Foundation, and the Instrument Society of America. Consultants Bureau, Inc., of New York, will do the translating and printing.

Contents of the February 1957 issue of *Avtomatika I Telemekhanika* included such articles as: Determination of Periodic Modes in Systems with Piece-Wise Linear Characteristics, Composed of Segments Paralled to Two Specified Straight Lines; Correction of Pulse Regulation and Control Systems; Two-Channel Automatic Regula-

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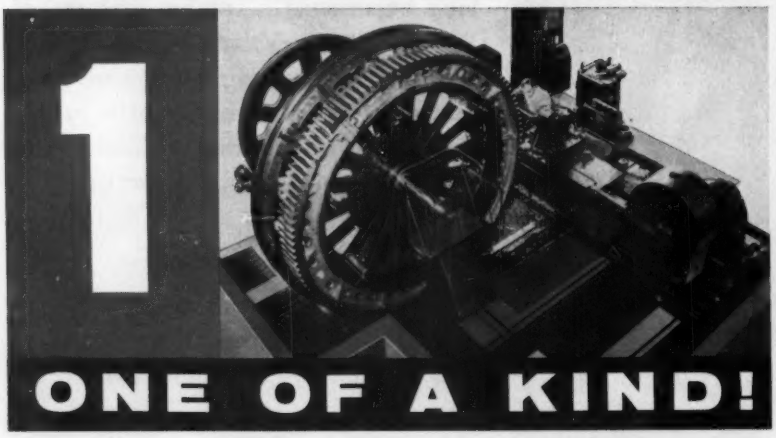

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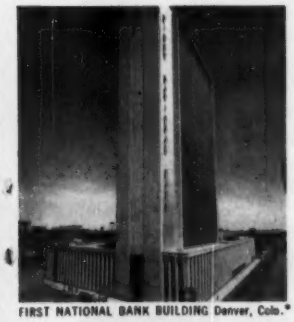

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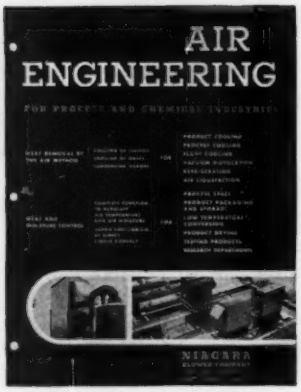

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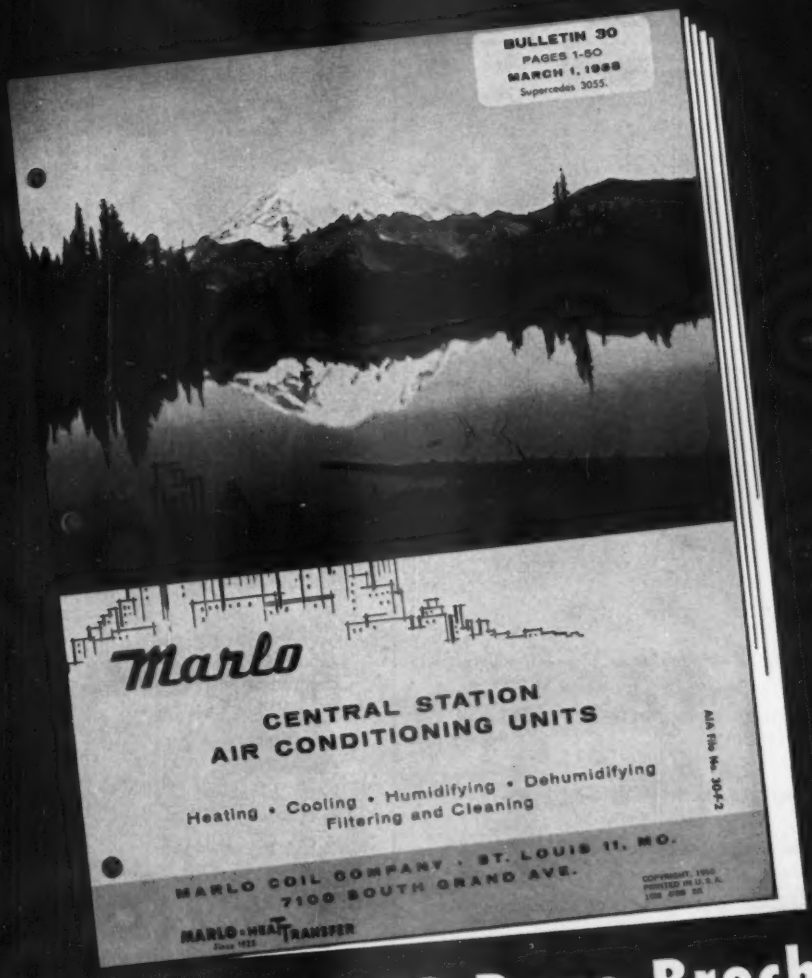

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Sept. 15-20	Engineers Joint Council	Sixth International Congress on Large Dams	Hotel Statler New York, N.Y.
Sept. 17-18	Building Research Institute	Conference on Floor Construction Systems	Sheraton-Park Hotel Washington, D. C.
Sept. 21-24	American Institute of Chemical Engineers	National Meeting	Hotel Utah Salt Lake City, Utah
Sept. 21-25	Prestressed Concrete Institute	Annual Meeting and Convention	Edgewater Beach Hotel Chicago, Ill.
Sept. 22-24	Standards Engineers Society	Seventh Annual Meeting	Benjamin Franklin Hotel Philadelphia, Pa.
Sept. 23-26	Association of Iron and Steel Engineers	Iron and Steel Exposition	Cleveland Public Auditorium Cleveland, Ohio
Sept. 28-Oct. 1	American Society of Mechanical Engineers	Power Conference	Hotel Statler Boston, Mass.
Sept. 29-Oct. 3	American Society of Tool Engineers	Semiannual Meeting	Shrine Exposition Hall Los Angeles, Calif.
Oct. 6-8	National Association of Corrosion Engineers	Salt Water Corrosion Conference	Hotel Somerset Boston, Mass.
Oct. 9-11	American Congress on Surveying and Mapping	Western Regional Conference	Monterey County Fairgrounds Monterey, Calif.
Oct. 13-15	American Institute of Electrical Engineers	National Electronics Conference	Hotel Sherman Chicago, Ill.
Oct. 13-17	American Society of Civil Engineers	Annual Convention	Hotel Statler New York, N. Y.
Oct. 23-25	National Society of Professional Engineers	Fall Meeting	St. Francis Hotel San Francisco, Calif.
Oct. 26-31	American Institute of Electrical Engineers	Fall General Meeting	Penn-Sheraton Hotel Pittsburgh, Pa.
Oct. 28	Association of Consulting Chemists and Chemical Engineers, Inc.	Annual Meeting	Biltmore Hotel New York, N.Y.
Nov. 17-20	American Institute of Electrical Engineers	Conference on Magnetism and Magnetic Materials	Sheraton Hotel Philadelphia, Pa.

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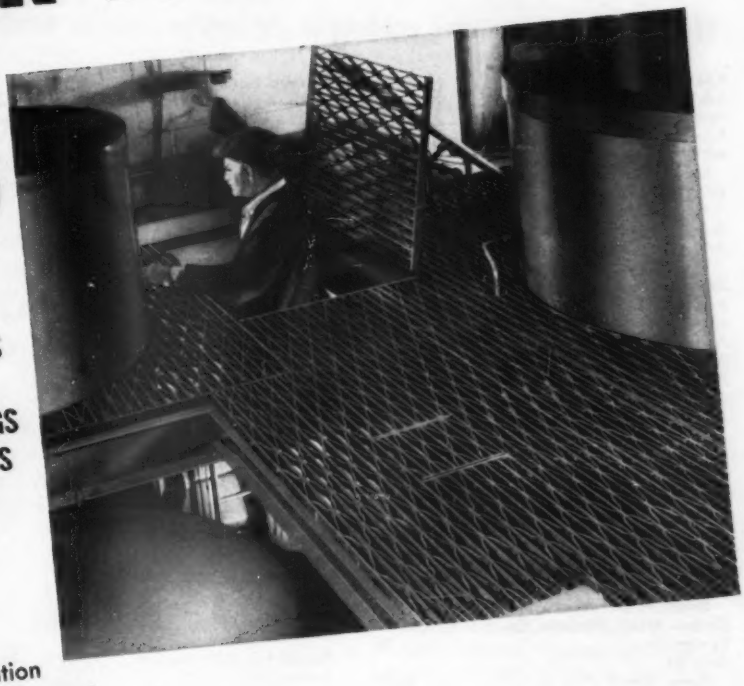

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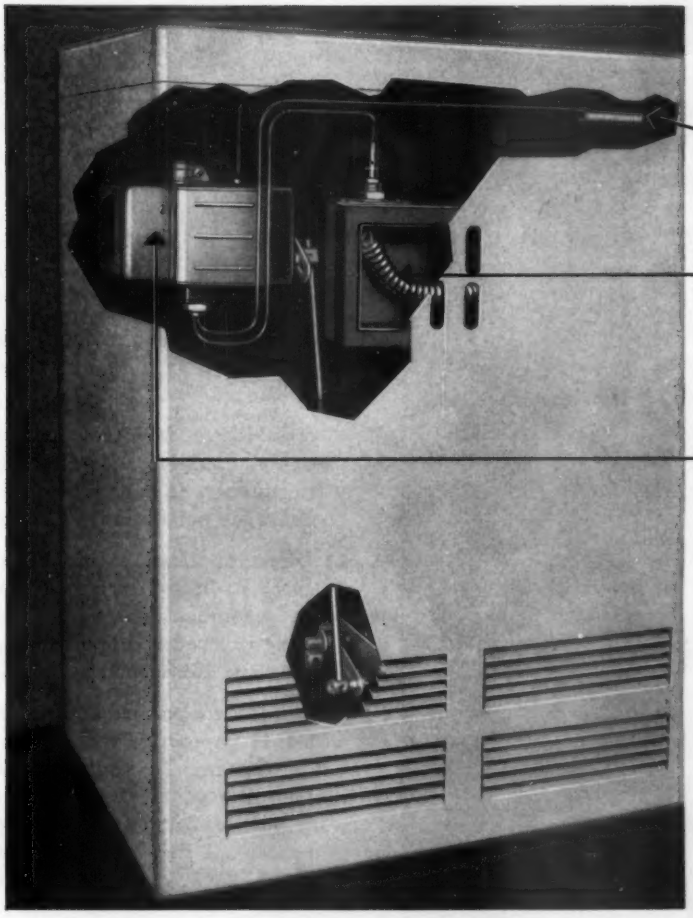

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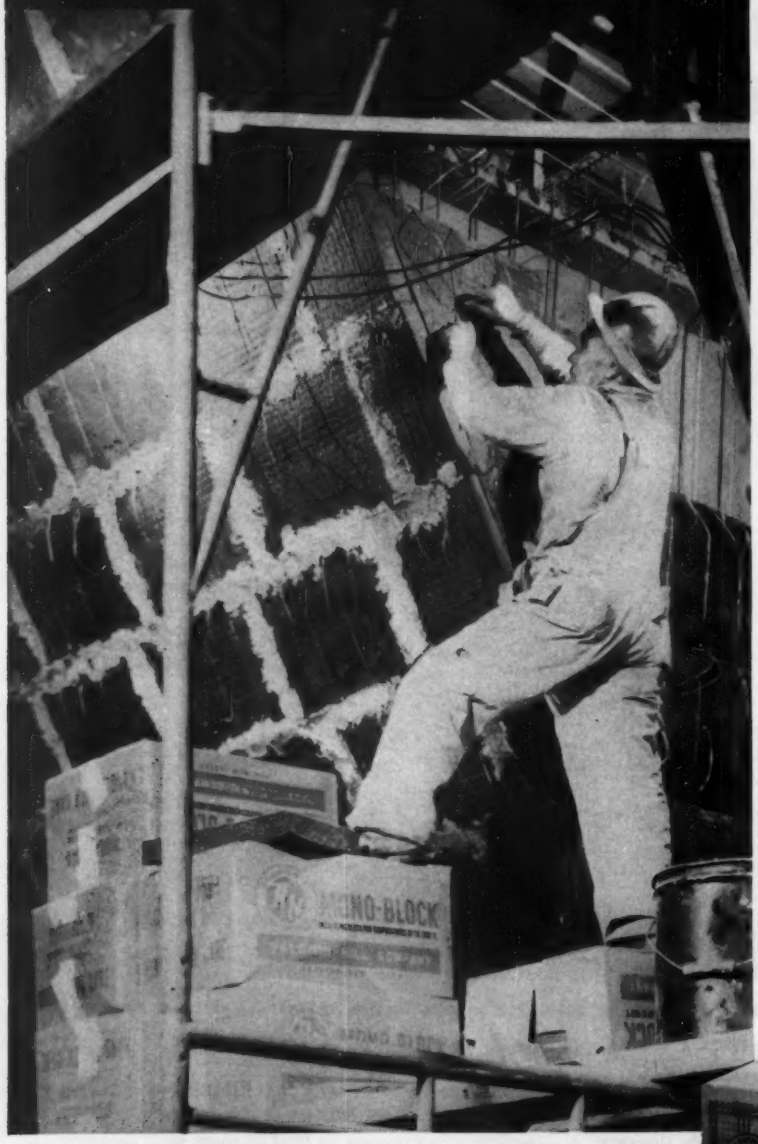
Again at DETROIT EDISON CO., Low Cost Thermal Efficiency . . . with BALDWIN-HILL MONO-BLOCK®



The high temperature resistance (to 1700°F), excellent structural strength, and fast, easy application of B-H Mono-Block helped determine its selection as basic insulation for the 1,720,000 lb per hr steam generating unit of Detroit Edison's River Rouge power plant.

On heated housings and ducts, two methods were used to apply the Mono-Block:

1) Spaced method: block supported on ¼" diameter rods attached to stiffeners so as to provide an unbroken outside finish surface.

2) Direct application: block secured to heated surface where flanges and stiffeners were too widely spaced to support spacer rods and the insulating block.

All joints were pointed and sealed with B-H Improved Super Powerhouse Cement. In addition, the larger areas of the boiler water walls were insulated with B-H spun mineral wool Blankets, 4" thick.

BALDWIN-HILL

Company

809 Breunig Ave., Trenton 2, N. J.

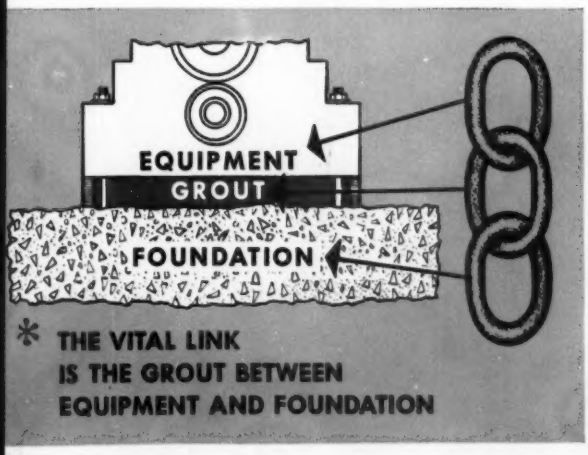
Kalamazoo, Mich. . . . Huntington, Ind. . . . Temple, Tex.

For more information on these products as well as other B-H Insulations, write for 1958 catalog —or see it in Sweet's Plant Engineering File.

One of two bays 100 ft. wide and over one-quarter mile long in the Mannesman Tube Co., Ltd. plant Sault Ste. Marie, Ontario. Engineer — Foundation of Canada Engineering Corporation; Contractor—Foundation Companies of Canada.

FIRST AUTOMATIC SEAMLESS TUBE MILL . . .

The Vital Link* is EMBECO Non-Shrink Grout



Flowable EMBECO† grout—the grout which does not shrink — was used in this plant to make the "vital link" a *dependable* link, to maintain precision alignment of costly equipment.

Standard in the industry, EMBECO non-shrink grout has been recommended and used by leading equipment manufacturers for more than 30 years.

Full information on EMBECO Pre-Mixed Grout on request — for easier, better grouting of heavy equipment, and for regrouting loose, misaligned equipment.

†EMBECO is a registered trademark of The Master Builders Co.

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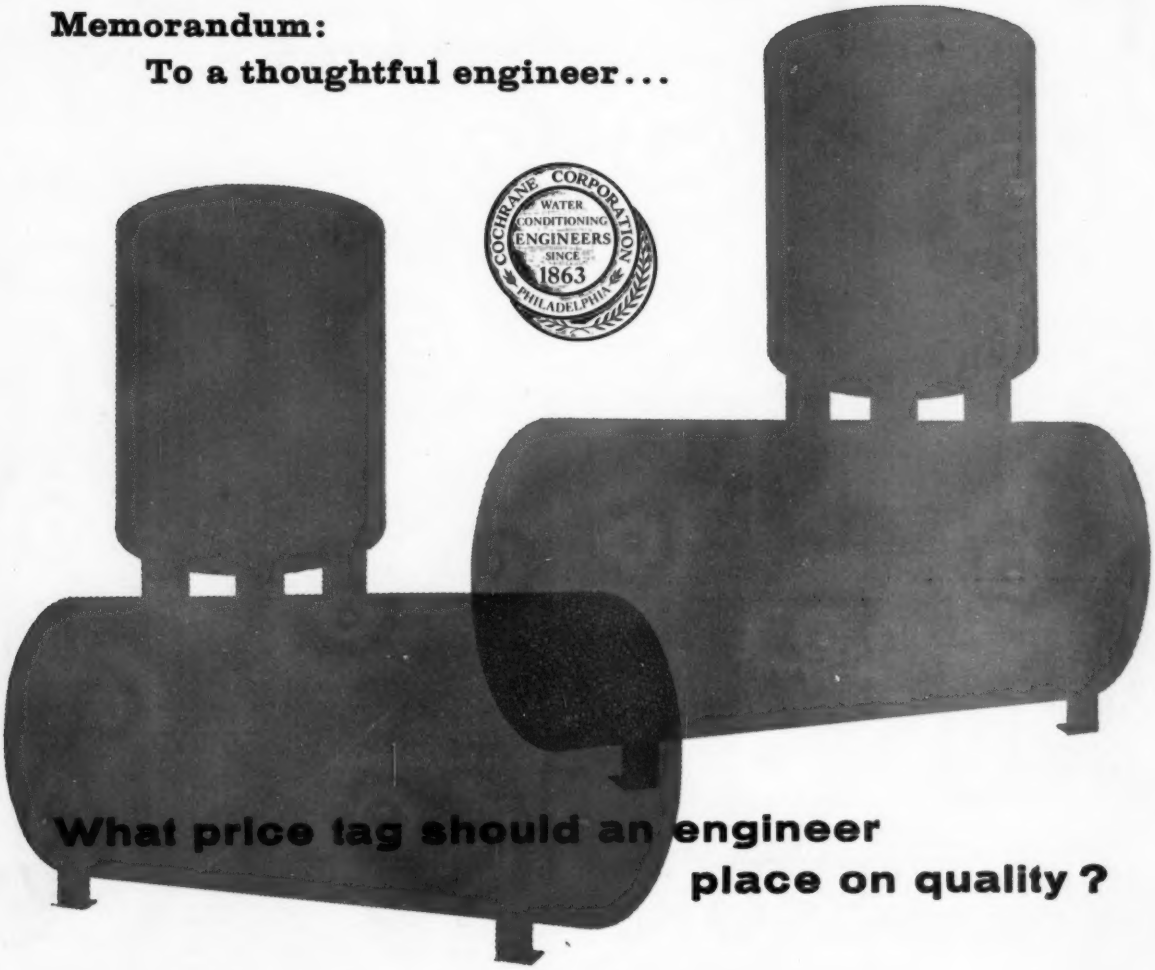
Memorandum:

To a thoughtful engineer...



What price tag should an engineer place on quality?

These two medium sized deaerators look alike. We designed both. They have the same outlet capacity, carry similar guarantees and meet the ASME code. But one costs $2000 more than the other.

Which is the better buy?

Obviously, you would want to know more about each unit in order to make a sound decision. Construction to ASME standards and basic guarantees are but part of the quality story. The higher priced unit, for example, has far heavier shell plate, more tray area and spilling edge, superior shell reinforcement, stainless instead of carbon steel baffle, anti-flash downtake. All of these features, we have found, are important to continued top performance.

As one of the world's largest and most experienced manufacturers of deaerators, we believe we know which unit is the better buy. Extra margins of strength and capacity—wisely selected—are not luxuries but sound investments that eliminate downtime and expensive field repairs.

That is why we recommend *quality*, and why thoughtful engineers insist on *quality*. If you are considering the purchase of deaerating equipment we are prepared to help you evaluate *all* the features that mean *true economy* in service. Ask for Bulletin 4650 on the "Why and How of Deaeration"

Write for these five bulletins on Deaeration—the problem, types of deaerators and applications.

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